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Tracing the Impacts of Rural Electrification in West Nile, Uganda

A Framework and Toolbox for Monitoring and Evaluation

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Foreword

SLE Postgraduate Studies on International Cooperation at the Humboldt Universität zu Berlin has trained young professionals in the field of international development cooperation for 49 years.

Three-month consulting projects conducted on behalf of German and international cooperation organisations form part of the one-year postgraduate course. In multidisciplinary teams, young professionals carry out studies on innovative future-oriented topics, and act as consultants. Including diverse local actors in the process is of great importance here. The outputs of this “applied research” are an immediate contribution to the solving of development problems.

Throughout the years, SLE has carried out over a hundred consulting projects in more than ninety countries, and regularly published the results in this series.

In 2011, SLE teams completed studies in Moldova, in Cameroon, in Uganda and in the Philippines.

The present study was commissioned and co-financed by KfW Entwicklungsbank. The study develops an results-based monitoring and evaluation framework for a rural electrification programme in West Nile, Uganda and also provides a manual for its implementation.

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Executive Summary

The Governments of Uganda and Germany are cooperating to improve the energy sector in Uganda. Within that sector, emphasis has been placed on establishing a reliable and efficient electricity supply in West Nile, a rural region in northern Uganda. The overall aim is to promote environmentally friendly socio-economic development in the region. To monitor and evaluate the results of the electrification programme, KfW Entwicklungsbank, a German development bank, has commissioned the present study. It will enable KfW and their partners to establish a sound, robust, state-of-the-art monitoring and evaluation system, and it may also offer useful suggestions to other development agencies active in the field of rural electrification.

Through KfW Entwicklungsbank, German development cooperation is investing in the construction of small hydropower plants and the extension of the electricity grid. About 40 trading centres[1] and towns will be electrified, permitting additional connections for about 6,000 households, 250 businesses, 60 schools, and 30 health centres.

In an electrified area the entire population could potentially benefit from the supply of electricity, for instance through the availability of refrigeration for vaccine storage in hospitals. However, at the individual level, the degree of access and benefit varies significantly. The ongoing debate on access to energy services thus proposes both qualitative and quantitative approaches to describe the extent of that access. However, these are difficult to adopt for a M&E framework.

The development of this M&E framework faced a threefold challenge:

- the conceptual challenge of providing a simple and practicable definition for access to energy services, defining beneficiaries whose access can be observed, and indicators by which access and its impacts can be measured;
- the methodological challenge of defining suitable units of analysis, capable of being sampled in a region with a population of 2.3 million spread over some 10,000 square kilometres, and against the background of very weak statistical base data;
- the implementation challenge of keeping the developed framework lean, manageable, and cost-efficient.

Tracking the mid-term and long-term results of rural electrification is challenging and requires a sound conceptual and methodological framework and a quantitative approach was developed. This focuses on access to electricity-based services, using the three access dimensions of availability, affordability and reliability. A set of indica-

1 Trading centres often stretch across several villages (the smallest administrative unit in Uganda) representing their local economic centres.

tors has been developed that describes all three dimensions of access in terms of the programme's Outcome for the connected and not connected households, businesses, schools, and health centres. These have been prioritised as the main beneficiary groups.

The four beneficiary groups have also been selected as units of analysis. Except for transportation businesses all types of businesses are included in the monitoring and also no restrictions are put onto households. For methodological reasons, and also in order to keep the framework practicable, only secondary schools have been selected for results-based monitoring. For the health centres, the lowest level establishments have been excluded, as their number is very large, while their potential use of electricity is limited.

For best result attribution, the double-difference approach has been applied predominantly. Health centres and secondary schools are surveyed by using 'not connected' institutions for comparison. Households and businesses are surveyed in connected and unconnected trading centres, while for six towns in West Nile a simple before-after comparison proved to be the only feasible option.

A full population survey is proposed for monitoring connected health centres and secondary schools, while unconnected ones will be sampled and monitored as a panel. However, the number of households and businesses is much larger, and no sampling frame is available. Therefore multi-stage sampling has been adopted, using trading centres and towns as preselected clusters from which households and businesses are randomly selected.

The study proposes a two-year M&E cycle, starting with the baseline survey in 2013, followed by three consecutive M&E cycles in 2015, 2017 and 2019. This will be completed by an evaluation, which will mainly use quantitative monitoring results and complement them with qualitative investigations. Each cycle includes a field survey, in which standardised interviews are conducted with 900 households, 825 businesses, and up to 170 secondary schools and 95 health centres. To complement this, an extensive data survey collects information from the electricity supplier in West Nile and from local and national authorities. In order to implement each M&E cycle, a consultant is required to supervise five survey teams, each consisting of a Ugandan coordinator and ten enumerators. A team of ten is also required for data entry.

Each element of the M&E framework and all the tools it contains have been repeatedly tested during their development. The practicability of the whole framework has been demonstrated through a pre-baseline in six trading centres and towns, during which 485 interviews were conducted. This data has also been used to illustrate theta processing and reporting routines.

Study results are presented in three parts. These are all built upon each other, but each can be used independently. Part I outlines the monitoring and evaluation

framework. Part II serves as a practical manual for the monitoring and evaluation process, whereas Part III sets out the reporting procedures.

Part I provides information on the background to and context of the electrification programme in West Nile. The results chain, together with its indicators, is presented and discussed. The formulation of the methodological approach to sampling and results attribution is explained.

Part II is written as a manual for implementing the monitoring procedures. As a step-by-step guideline, it describes in detail all the activities that need to be completed, and gives valuable information on the survey procedure. An extensive Digital Annex[2] provides numerous supporting documents to facilitate the implementation process.

Finally, Part III presents the tools for reporting. An indicator sheet has been developed for each indicator. This includes a brief description and discussion, and is complemented by easy-to-read charts. Part III concludes with recommendations on the analysis and a discussion of M&E results.

The following format is used throughout when referencing other sections: 'Part'–'Chapter'.'Section'. For example, 'I–3.1' denotes of Part I, Chapter 3.1. Accordingly, the abbreviation DA is used to refer to the Digital Annex.

2 The Digital Annex as a compressed data archive and the report as digital document are available from the SLE website (http://www.sle-berlin.de/index.php/de/studium/publikationen/studien).

Zusammenfassung

Die ugandische und die deutsche Regierung haben ein Kooperationsabkommen unterzeichnet, um gemeinsam den Energiesektor in Uganda zu verbessern. In einem offenen Sektorprogramm wurde auch die verlässliche und effiziente Elektrizitätsversorgung in West Nile, einer ländlichen Region im Norden Ugandas, zu einem Schwerpunkt erklärt. Das Ziel ist, zu einer umweltfreundlichen und sozio-ökonomischen Entwicklung in der Region beizutragen.

Im Rahmen der deutschen Entwicklungszusammenarbeit investiert die KfW Entwicklungsbank in West Nile in den Bau von Kleinwasserkraftwerken und die Erweiterung des Stromnetzes. Dadurch sollen in rund 40 lokalen Handelszentren und sechs Städten zusätzlich mindestens 6.000 Haushalte, 250 Unternehmen, 60 Schulen und 30 Gesundheitsstationen angeschlossen werden.

Die vorliegende Studie wurde von der KfW Entwicklungsbank in Auftrag gegeben, um die Auswirkungen des Elektrifizierungsprogramms in West Nile zu erfassen zu können. Die Ergebnisse der Studie ermöglichen der KfW und ihren Partnern, ein fundiertes und zeitgemäßes Monitoring und Evaluierungssystem einzuführen. Sie bieten zudem Anregungen für andere Entwicklungsagenturen, die im Bereich der ländlichen Netzelektrifizierung tätig sind.

Grundsätzlich profitieren alle Einwohner eines elektrifizierten Gebiets von Netzstrom, beispielsweise durch eine verbesserte Gesundheitsversorgung aufgrund gekühlter Impfstoffe. Jedoch unterscheidet sich erheblich, wie der Einzelne von Stromzugang und entsprechenden strombasierten Energiedienstleistungen profitieren kann. In der entwicklungspolitischen Debatte über den Zugang zu Energiedienstleistungen werden deshalb qualitative als auch quantitative Herangehensweisen zur Bewertung des Zugangs diskutiert. Diese Ansätze in einem anwendbaren M&E System zu berücksichtigen, stellt jedoch eine erhebliche Herausforderung dar, und so mussten bei der Entwicklung des vorliegenden Frameworks drei Schwierigkeiten gelöst werden:

- Die konzeptionelle Herausforderung, eine einfache und praktikable Definition für den Zugang zu Energiedienstleistungen zu entwickeln, wodurch die Beobachtung des Zugangs für bestimmte Nutznießer operationalisierbar und mit Hilfe von Indikatoren messbar ist.
- Die methodologische Herausforderung, geeignete Untersuchungseinheiten für die Erhebung zu definieren in einer etwa 10.000 km² großen Region mit einer Bevölkerung von 2,3 Millionen, für die kaum verlässliche, statistische Daten zur Verfügung stehen.
- Die Herausforderung, dass System wirkungsorientiert und gleichzeitig anwendbar zu gestalten, um damit eine kosteneffiziente Implementierung zu ermöglichen.

Da die mittel- und langfristigen Auswirkungen von ländlicher Elektrifizierung differenziert zu erfassen sind, bedarf es eines soliden konzeptionellen und methodischen Unterbaus. Das Programmziel (Outcome) ist der verbesserte Zugang zu strombasierten Dienstleistungen. Als Konsequenz entwickelt die Studie einen überwiegend quantitativen Ansatz, der den Zugang zu Netzstrom über drei Dimensionen erfasst: die Verfügbarkeit, die Erschwinglichkeit und die Zuverlässigkeit. Für diese Dimensionen werden Indikatoren entwickelt, über die sich der Zugang für angeschlossene und nicht angeschlossene Haushalte, Unternehmen, Schulen und Gesundheitsstationen beschreiben lässt. Diese Gruppen werden in der Studie als wichtigste Begünstigtengruppen priorisiert und als Untersuchungseinheiten ausgewählt.

Die genannten vier Begünstigtengruppen werden in das M&E-System als Untersuchungseinheiten einbezogen. Außer Transportunternehmen werden alle Arten von Unternehmen berücksichtig und es werden auch keine Restriktionen bei Haushalten festgelegt. Aus Gründen der Methodik und Anwendbarkeit werden hingegen nur Sekundarschulen für das wirkungsorientierte M&E berücksichtigt. Die Gesundheitsstationen haben staatlich zuerkannte Versorgungsniveaus. Diejenigen Einrichtungen mit dem niedrigsten Versorgungsniveau werden vom M&E-System nicht berücksichtigt, da hier von einer geringen Stromnutzung auszugehen ist.

Um die Wirkungen dem Elektrifizierungsprogramm bestmöglich zuzuordnen, wird im methodischen Design der Differenzen-in-Differenzen-Ansatz bevorzugt angewendet. Das erfordert die Auswahl von geeigneten Vergleichsgruppen ohne Stromzugang. Für die Gesundheitszentren und Sekundarschulen sind dies die Institutionen, die nicht ans Stromnetz angeschlossenen sind. Die Haushalte und Unternehmen werden zwischen elektrifizierten und nicht-elektrifizierten lokalen Handelszentren verglichen. Für die sechs Städte, die in West Nile betrachtet werden, konnten keine Vergleichsgruppen identifiziert werden. Deshalb wird hier ein einfacher Vorher-Nachher-Vergleich empfohlen.

Für die im Rahmen des Programms zusätzlich elektrifizierten Gesundheitsstationen und Sekundarschulen wird eine Vollerhebung vorgeschlagen. Diese werden dann, im Sinne des Differenzen-in-Differenzen-Ansatzes, einem repräsentativ gewählten Panel an nicht elektrifizierten Gesundheitsstationen und Sekundarschulen als Vergleichsgruppe gegenübergestellt. Weil die Anzahl der Haushalte und Unternehmen sehr viel größer ist und eine statistische Auswahlgrundlage fehlt, wird ein mehrstufiges Stichprobenverfahren angewendet. In einem ersten Schritt werden alle lokalen Handelszentren und Städte in Cluster aufgeteilt und daraus eine Stichprobe gezogen. In einem zweiten Schritt werden dann in den identifizierten Orten Haushalte und Unternehmen zufällig ausgewählt.

Die Studie schlägt einen zweijährigen M&E Zyklus vor, beginnend mit einer Baseline 2013, gefolgt von drei M&E Zyklen 2015, 2017 und 2019. In jedem Zyklus wird die

Datenerhebung mit standardisierten Interviews durchgeführt. Insgesamt sollen jeweils 900 Haushalte und 825 Unternehmen befragt werden. Die Anzahl der zu elektrifizierenden Sekundarschulen und Gesundheitsstationen stand zum Zeitpunkt dieser Studie noch nicht endgültig fest. Schätzungsweise müssen jedoch bis zu 170 Sekundarschulen und 95 Gesundheitsstationen befragt werden. Zusätzlich werden auch Daten vom Stromversorger in West Nile sowie lokalen und nationalen Behörden erhoben. Die gesamte Durchführung eines M&E-Zyklus wird von einem Consultant koordiniert. Fünf Datenerhebungsteams mit jeweils einem ugandischen Koordinator und fünf Enumeratoren, sowie zehn Personen für die Dateneingabe werden für die Durchführung benötigt.

Alle Verfahren und Instrumente des M&E Frameworks wurden wiederholt auf ihre Anwendbarkeit und Aussagefähigkeit geprüft. Die Praktikabilität des kompletten Frameworks wurde mittels einer umfangreichen Teststudie (Pre-Baseline) unter Beweis gestellt, für die in drei lokalen Handelszentren und drei Städten insgesamt 485 Interviews geführt wurden. Die erhobenen Daten wurden auch genutzt, um die Datenanalyse und das Berichtsformat zu veranschaulichen.

Die vorliegende Studie gliedert sich in drei aufeinander aufbauende Teile, die auch unabhängig voneinander genutzt werden können. Teil 1 beschreibt das M&E Framework, Teil 2 dient als praktisches Manual für die Monitoring- und Evaluierungsprozesse und Teil 3 legt das Berichtsformat dar.

Teil 1 stellt den Hintergrund und den Kontext des Elektrifizierungsprogramms in West Nile vor. Die Wirkungskette und die Indikatoren werden dargestellt und diskutiert sowie der methodische Ansatz für die Wirkungszuordnung und das Sampling formuliert.

Teil 2 ist ein Manual für die Umsetzung der Monitoring-Aktivitäten. Schritt für Schritt wird erklärt, wie die Aktivitäten durchgeführt werden sollen. Zusätzlich werden nützliche Hintergrundinformationen für die Feldphase gegeben.

Zum Abschluss werden in Teil 3 die Instrumente des Berichtsformats vorgestellt. Für jeden Indikator wurde ein Indikatoren-Blatt ausgearbeitet, das eine kurze Beschreibung und Diskussion des jeweiligen Indikators enthält und durch ein oder mehrere Diagramme veranschaulicht wird.

Für die Referenzierung innerhalb der gesamten Studie wird folgende Schreibweise verwendet: ‚Part'–‚Chapter'.‚Section'. Zum Beispiel steht ‚I–3.1' für Part I, Kapitel 3.1. Die Abkürzung DA wird für die Referenzierung auf den digitalen Annex benutzt.

Content Overview

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Abbreviations

BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung
B	Business
CAO	Chief Administrative Officer
DA	Digital Annex
ERA	Electricity Regulatory Authority
EUR	Euro
GHG	Green house gas
GIZ/GTZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HC	Health centre
HH	Household
ICT	Information and communication technologies
IEA	International Energy Agency
IPCC	Intergovernmental Panel for Climate Change
IPS	Industrial Promotion Services Limited
KfW	Kreditanstalt für Wiederaufbau
LPG	Liquefied petroleum gas
M&E	Monitoring and Evaluation
MDGs	Millennium Development Goals
MEMD	Ministry of Energy and Mineral Development
MoE	Ministry of Education and Sports
MoH	Ministry of Health
NGO	Non-governmental organisation
NUS	Northern Uganda Baseline Survey
REA	Rural Electrification Agency
SHP	Small hydropower
SLE	Seminar für Ländliche Entwicklung
TC	Trading centre
UBoS	Uganda Bureau of Statistics
UDHS	Ugandan Demographic and Health Survey
UEDCL	Uganda Electrification Distribution Company Limited
UEGCL	Uganda Electrification Generation Company Limited
UGX	Uganda Shilling
UNEB	Uganda National Examination Board
UNHS	Uganda National Household Survey
URA	Uganda Revenue Authority
WENRECo	West Nile Rural Electrification Company Limited

Units

A	Ampere
hr	Hour
J	Joule
kg	Kilogram
kWh	Kilowatt-hour
l	Litre
MJ	Megajoule
MWh	Megawatt-hour
MVA	Megavolt ampere

Part I

M&E Framework

Contents

1 Introduction

Part I of this report describes the development of the monitoring and evaluation (M&E) framework for the West Nile electrification programme. This required three major challenges to be addressed:

- identifying and attributing the results of rural electrification;
- balancing the needs of results-based monitoring with the needs of evaluation processes;
- balancing the effort involved in M&E activities with their usage and benefits (programme management, reporting, learning).

The framework presented here aims to address these challenges and needs by proposing a comprehensive but practicable system. This system has already been tested during three months of field work which the SLE study team conducted in West Nile, Uganda.

Within this Part I, Chapter 2 provides essential background information on the region of West Nile, the electrification programme, its stakeholders and the assignment entrusted to the SLE study team. Chapter 3 then clarifies important terms and approaches and briefly depicts the conceptual and methodological foundations on which the M&E framework is constructed. Building on this introduction, Chapter 4 outlines the conceptual design of the M&E framework. It specifies the expected programme results that are to be measured, the groups for which these results are expected, and the indicators used to measure the results. Chapter 5 describes the methodical design. It explains the underlying assumptions and general decisions made in defining units of analysis, survey areas, comparison approaches and representativeness for the M&E framework. It includes a sampling proposal and an explanation of the sources and tools for data collection, as well as data processing and analysis. Finally, Chapter 6 focuses on the implementation of the M&E framework. It describes the phases of implementation and the various responsibilities for M&E activities.

2 Background

Development cooperation between Uganda and Germany resumed after the civil war in Uganda ended in 1986. For the period from 2010 to 2012, the German Government has committed EUR 120 million in new funding for three priority areas: water supply and sanitation; financial sector development; and renewable energy and energy efficiency. The main objectives for German-Ugandan cooperation in the energy sector are to improve access to renewable and sustainable energies and to promote efficient energy use (BMZ 2010). Priority is given to rural areas, especially in Northern Uganda, where the promotion of a sustainable and vigorous energy sector is crucial to achieve pro-poor-growth. As such, German Development Cooperation – through KfW Entwicklungsbank – is financing an electrification programme in West Nile (see Figure 1), a rural area in Northern Uganda.

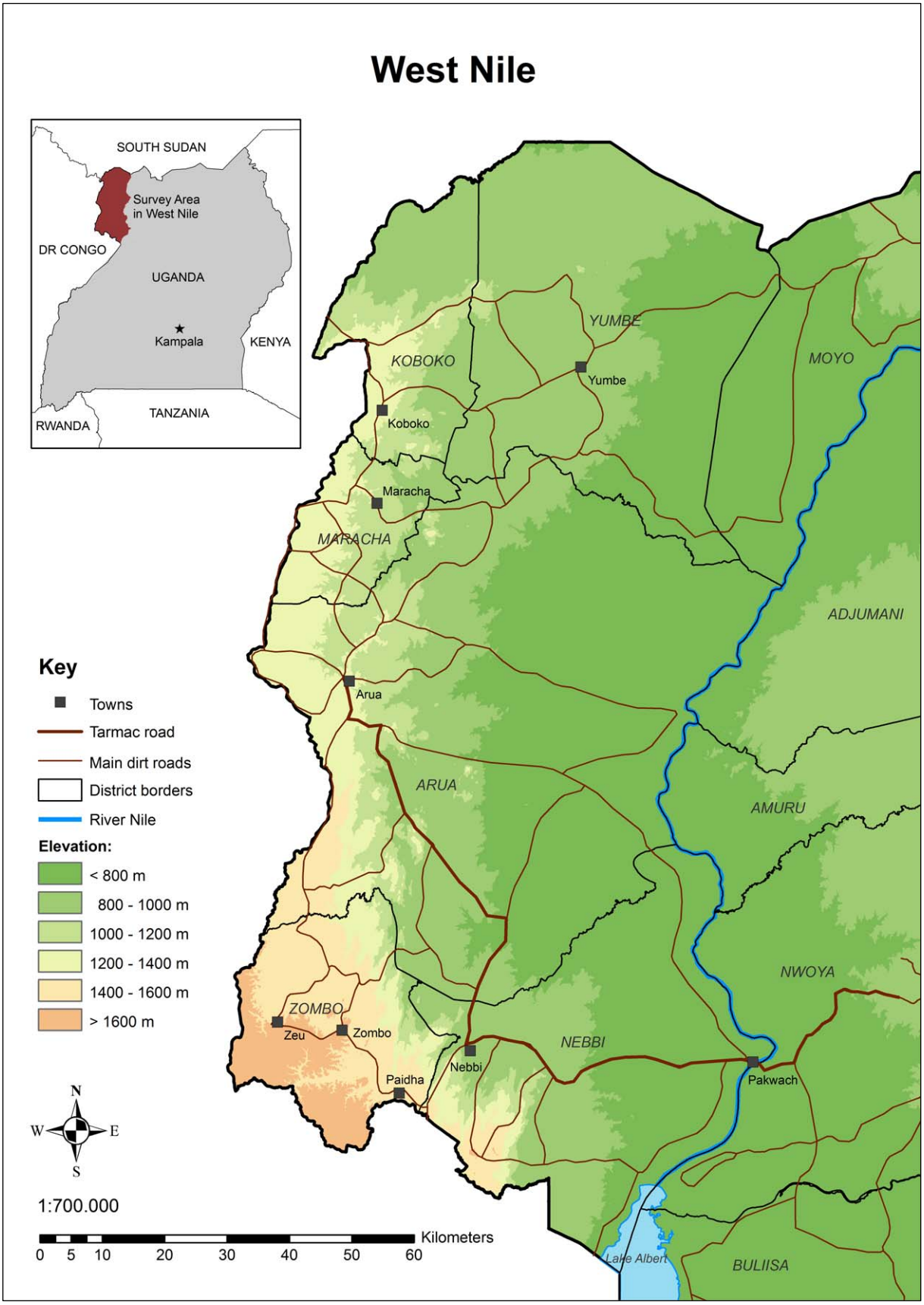
In Uganda, only nine per cent of the population currently has access to electric power (IEA 2010) and 91 per cent of primary energy demand is covered by biomass combustion (MEMD 2008). The situation is even more precarious in West Nile, where the proportion of the population with access to electricity is negligible.[3] West Nile is currently not connected to the national grid. There are plans for an interconnection but implementation cannot be expected before 2025, at the earliest.

Located in northwest Uganda at the borders of the Democratic Republic of Congo and the newly created state of Southern Sudan, West Nile is composed of eight districts, six of which form the intervention area for the electrification programme: Arua, Koboko, Maracha, Nebbi, Zombo, and Yumbe. All in all more than 2.3 million people from five ethno-linguistic groups are spread across the region, which has experienced a period of prolonged armed conflicts that only came to an end in 2002.

As a result, West Nile is one of the poorest and most neglected regions in Uganda. West Nile is predominantly an agricultural region, with the vast majority of the population living off subsistence farming. But it also includes several dynamic towns, e.g. Arua and Koboko, which profit from their locations close to the international borders. Annex 1 gives a more detailed outline of West Nile while Annex 2 summarises the main sources for data and information on West Nile.

3 Currently only about 1,500 households are connected to the island power grid. There is also an unspecified number of small generator sets and solar home systems in the region.

Figure 1: Map of West Nile, Uganda



2.1 The rural electrification programme in West Nile

To address the acute shortage of electric power in the region, German development cooperation through KfW Entwicklungsbank, in partnership with the Ministry of Energy and Mineral Development (MEMD) and the private sector, has launched an open sector investment programme, “Investments in Renewable Energy and Energy Efficiency in Uganda” (programme period June 2008 to May 2017).

Following a competitive selection process, a concession for the generation, distribution and sale of electricity in West Nile was awarded to the West Nile Rural Electrification Company (WENRECo) in 2003, for a period of 20 years. WENRECo inherited the existing infrastructure (some small diesel generators and a small distribution grid, mainly serving Arua town) and invested in a 1.0 MVA heavy fuel oil generator and the construction of a small hydropower plant (SHP Nyagak I, 3.5 MW), which has not yet been completed.

The electricity price is regulated at national level and is, in principle, cost-reflective. However, the concession was awarded on the basis of a financial model that assumed WENRECo would make losses until Nyagak I came online, after which the company would be able to recoup those losses and also turn a profit. However, the completion of the hydropower plant (started in late 2006) was continuously delayed, and hence in 2008 WENRECo was at risk of insolvency.

One target of the open sector investment programme is to improve the electrification situation in West Nile. Several programme components were identified in pursuit of this target, namely: the construction and rehabilitation of electricity infrastructures; new payment schemes; and awareness campaigns aimed at improving productivity, safety and efficiency in the use of electricity. It is planned that this last component will be implemented by the German Gesellschaft für Internationale Zusammenarbeit (GIZ), whereas the infrastructure investments are co-financed by KfW. The overall objective of these German investments is to provide access to electricity for at least 6,000 households, 30 health centres, over 60 schools, and a minimum of 250 businesses in West Nile.

The West Nile investment programme is jointly financed by the Government of Uganda (EUR 7.5 million), WENRECo (EUR 5.5 million), KfW (EUR 24.6 million), and the Energy Facility Pooling Mechanism (EUR 3.5 million) of the European Union for the African, Caribbean, and Pacific Group of States. Hence, for the period March 2011 to March 2014, the budget estimate totals EUR 41.1 million. Table 1 lists the components of the West Nile investment programme (KfW 2010):

Table 1: Components of the West Nile investment programme co-financed by KfW

Components	Project-executing agency	Operation and maintenance	Budget estimate (EUR)
Completion of Nyagak I small hydropower plant	WENRECo	WENRECo	11.6 million
Construction of Nyagak III small hydropower plant	Uganda Electricity Generation Company Ltd. (UEGCL)	WENRECo	13.5 million
Grid extension and rehabilitation project	Uganda Electricity Distribution Company Ltd. (UEDCL)	WENRECo	11.7 million
Switching the island network from post-paid to prepaid metering	WENRECo	WENRECo	0.5 million
Grid densification project	WENRECo, GIZ	WENRECo	0.5 million
Deployment of implementation consultants			3.3 million

2.2 Actors in the electricity sector in West Nile

The West Nile Rural Electrification Company (WENRECo) holds a concession to generate, distribute, and sell electricity in West Nile until 2023, and is the most important local actor. The company is fully owned by the Ugandan branch of the Kenyan Industrial Promotion Services Limited (IPS). IPS is in turn majority-owned by the Aga Khan Fund for Economic Development. The German Investment and Development Company (DEG) owns a 14.1 per cent equity stake in IPS. The Ugandan government will increase its stake in WENRECo in the future by converting public subsidies into equity shareholding. Currently the company employs about 40 people in three departments: power generation, distribution, and administration.

MEMD is responsible for general energy policy in Uganda and has directly signed the implementation and subsidy agreement with WENRECo. Rural electrification programmes and activities are financed by the Ugandan Rural Electrification Agency (REA) which, as part of MEMD, is also responsible for general rural electrification policy and targets. REA manages the Rural Electrification Fund and offers subsidies for small local electricity grids such as that in West Nile. As well as the grid extension co-financed by KfW, REA directly finances small grid sections in the main towns in West Nile that are operated by WENRECo.

Electricity concessions and tariffs in Uganda are regulated by the Electricity Regulatory Authority (ERA). ERA also assigned the concession to WENRECo and monitors the company’s performance in relation to its concession. Thus WENRECo has to provide quarterly reports, and all WENRECo electricity tariffs must be approved by ERA.

The Uganda Electricity Generation Company (UEGCL) will be the owner of the planned SHP Nyagak III. The newly built distribution extensions will be formally owned by the Uganda Electricity Distribution Company (UEDCL). However, all assets will be operated by WENRECo under operation and maintenance agreements that are yet to be signed.

2.3 KfW brief to the SLE study team

KfW decided to invest in a comprehensive, results-based monitoring and evaluation (M&E) system. The objectives are: to improve programme management; enhance learning and reporting processes; ensure results-oriented implementation of programme activities; and analyse the combining financial cooperation investments. To this end, KfW commissioned the SLE to develop a logically consistent M&E framework and a practical manual for its implementation. The assignment included several tasks:

- assessing the results chain as defined in the Joint Programme Proposal;
- assessing the methodology used to measure the number of beneficiaries;
- formulating Output and Outcome indicators;
- wherever possible, establishing baseline data. Where data is impossible to obtain, presenting alternative proposals;
- defining roles and responsibilities in M&E implementation;
- defining M&E procedures and intervals.

After a preparatory phase which took place in Berlin during June and July 2011, the SLE study team conducted its field work in Uganda from August to October 2011. The M&E framework that had been developed was operationalised during the field work phase, and each of its elements (concept, methodology, and implementation) were tested in practice. The feasibility of the developed M&E approach was demonstrated by carrying out pre-baseline surveys in three towns and three trading centres in West Nile. The results have been presented to, and discussed with, local stakeholders in both West Nile and Kampala.

3 Conceptual and Methodological Considerations

The objectives of results-based monitoring and evaluation are to improve programme management based on results information and to assess the difference that is made to people's lives. To better understand the results-based M&E framework, some conceptual and methodological foundations are set out below. These focus on:

- the concept of access to electricity-based services;
- the approach of results-based monitoring and evaluation;
- the attribution problem in measuring indirect results;
- different sampling approaches for obtaining representative data.

3.1 Access to electricity in rural areas

Electrification, understood as the physical set up of electricity generation and distribution infrastructure, is generally considered a prerequisite for industrial development and therefore a prominent element of most national energy policies.[4] In 2009, about 1.4 billion people worldwide had no access to electricity, of which 85 per cent were living in rural areas (IEA 2010: 240). Even though access to electricity and energy in general is not part of the Millennium Development Goals (MDGs), it is considered an important cross-cutting issue (Modi 2005). Its relevance for sustainable development has recently been highlighted by the UN General Secretary, by setting the ambitious target of universal energy access, including access to electricity, by 2030 (AEGCC 2010).

Challenges of rural electrification

For many decades, the extension of national power grids to rural areas has been the dominant strategy for increasing the electrification rate. However, these national electrification programmes have only succeeded in reaching significant proportions of the (often poor) rural population in relatively few cases (Barnes 2005, World Bank 2008). This is mainly due to the following challenges:

- the high costs of investment and operation for rural distribution networks, which cannot be recovered from the comparatively low level of rural electricity consumption, especially with nationally regulated electricity prices;

4 Such energy policies, especially for rural areas, usually also encompass access to clean and sustainable fuels for heating and cooking (Legros et al. 2009). As the aim of the present study is to develop a monitoring and evaluation framework for a rural electrification programme, the focus here is on electrification only.

- the limited purchasing power of rural customers, who can afford neither the expense of the initial connection nor even their own monthly electricity consumption;
- the poor reliability and quality of the electricity supply (blackouts, brownouts, voltage spikes) which, from a customer's perspective, detracts from the costly investment required in a connection and electrical appliances;
- the limited local availability and quality of electrical appliances.

As a consequence, new approaches have been tested to reduce costs and increase availability by setting up isolated local and regional electricity grids (mainly diesel or hydro-powered), or by distributing (mainly solar-powered) stand-alone systems (e.g. Solar Home Systems).

Electricity supply and energy services

Together with these new approaches to electricity supply, the perception of the electricity system itself has also changed. The former picture of the electricity sector focused mainly on the supply side, by describing the conversion of primary energy resources into electricity, and its subsequent transport and distribution to the customer. In a modern understanding, however, the customer does not desire electricity itself, but the services that can be derived from its use. Most energy services thus require specific appliances which, in most cases, could be either fuel-based or electrical, and can be clustered into the following five groups:

- lighting;
- heating (cooking, space/water heating, process heat);
- cooling (of space, food or medicine);
- mechanical power (for transport and stationary machines);
- information and communication technologies (ICT).

It is difficult to define the quality of an energy service (e.g. a 'sufficiently' illuminated or heated space, or 'sufficiently' cooked food) in an objective manner, as this perceived quality strongly depends on the expectations of the user as well as the way the service is used. However, electricity and electrical appliances are generally considered to be comfortable, clean, comparably cheap, and universally usable. They deliver also services that cannot be provided by other means, especially ICT-services.

Electrical appliances therefore compete with, and can substitute for, fuel-based appliances. But the reason to switch from fuel-based to electrical appliances includes other aspects beyond perceived service quality and the convenience and safety of their use. In particular, their investment and operation costs, and the availability and reliability of both the appliances and the fuel or electricity supply.

Access to electricity-based services

As a consequence, simply establishing a distribution extension to a village (by placing a transformer station at the village centre) or even the physical connection of a household (by providing a low voltage power line, a meter and house wiring) is not sufficient in itself to guarantee the use of electricity-based services. Because the customer also needs to invest in electrical appliances, both the electricity supply and the appliances themselves need to be readily available, affordable, and reliable in order to make electricity a competitive alternative to fuel-based energy services.

We have conceptualised the access to energy services as the combination of these three dimensions, comprising both the short-term as well as the long-term perspective. In addition, the degree to which a person has access to each energy service is described as a continuum. In this context:

- availability means the physical presence of electricity and electrical appliances within appropriate reach of the user;
- affordability describes to what extent the combined cost of the connection, the electricity itself and the end-use appliance is both manageable and reasonable for the user;
- reliability is understood as a continued power supply quality (no blackouts, brownouts or voltage spikes), as well as the quality of end-use appliances.

As a consequence of this comprehensive understanding of the concept, an investment programme can contribute to an improved access. But such a programme cannot cover every aspect of it, e.g. the availability of appliances. This needs to be considered in the elaboration of impact hypotheses and the results chain.

Impacts of an improved access to electricity-based services

An increased access to electricity-based services is expected to have positive impacts on regional socio-economic development. Main impact categories described in the literature are (1) the reduction of indoor air pollution due to decreased fuel combustion for lighting and cooking, (2) the possible increase of productivity in agricultural processing and other manufacturing, and (3) improved social services e.g. in schools and health centres (Modi 2005, Ramani and Heijndermans 2003).

However, realising such impacts largely depends on the degree of access that can be achieved for households, businesses and social institutions, as well as on numerous other factors, which empower and drive specific user groups. Access to electricity-based services might also have negative results. If a substantial share of the household income is spent on the electricity bill without any income-generating effects, then the amount of money available for food, school fees or healthcare might be reduced. Furthermore, recent debates have served to highlight the subjective and

relative character of poverty. If only a few households in rural areas gain access to electricity, the disadvantage felt in the poorest households might even increase.

3.2 Results-based monitoring and evaluation

In international development cooperation, monitoring is a continuous process of systematic data collection and analysis to provide information on the progress, problems, and use of funds in a development intervention. Monitoring is carried out while the intervention is still running, and it assesses the actual situation in comparison with that which was intended. Data collected in such activity- and output-oriented M&E systems is mostly quantifiable, e.g. the number of grid connections or the number of solar systems installed. During an evaluation the collected data is typically supplemented by, and contrasted with, further information, often of a qualitative nature, and the whole is then systematically and objectively assessed.

By contrast, a results-based M&E system emphasises the measurement of results on three levels, namely Use of Output; Outcome; and Impact. These systems, for example, cover not only the number of grid connections provided, but trace what difference the programme makes in people's lives. In this way, results-based M&E activities enable stakeholders to better target the desired development impacts and to adapt to changing situations. Moreover, by conducting assessments on a regular basis, the sustainability of results can be tracked.

The basis for such a M&E system is a results chain. It describes in which way programme activities (e.g. financing the installation of turbines and generators) and planned outputs (e.g. new generation capacities) are intended to lead to the achievement of desired direct results (e.g. improved access to electricity-based services) and to more indirect results (e.g. improved delivery of health services).

The results chain can be extended to include potential external factors that may influence the programme's success, as well as possible unintended side effects from the intervention. All these elements can be displayed in an impact map. For the development of an impact map, it is important to sketch reasonable impact hypotheses, which set out base assumptions on cause-effect relationships (e.g. if a shop owner is connected to the grid, he can work under artificial light in the evening, and can thus raise his income by being more productive).

To measure if the objectives of the programme are reached, indicators need to be developed for each level of the results chain. They provide evidence that a certain condition exists or that certain results have or have not been achieved. They can either contain quantitative variables (e.g. the number of appliances owned by a household) or qualitative variables (e.g. a subjective assessment of living conditions). Good indicators need to be specific, measurable, attainable, relevant, and time-bound.

Impact evaluation aims to extract the net effects that an intervention has on more aggregated result variables or indirect benefits. To this end, impact evaluation aims to attribute the observed changes to the intervention and to other external factors. The higher and more aggregated the result variables are, the more difficult this becomes, due to the attribution problem (Peters 2009, Bensch et al. 2011).

3.3 Approaches for results attribution

A results-based M&E system provides information on specific and definable units of analysis (Kromrey 2002: 267). For each unit of analysis, a parent population (Kromrey 2002: 261) must be defined. If, for instance, the unit of analysis is a household, the parent population would be all households of a specific characteristic or within a specific area. To clearly attribute the changes on a unit of analysis caused by an intervention, the situation with the intervention (the factual) ought to be compared with the same situation without the intervention (the counterfactual). Yet, this comparison is not possible, because the same unit of analysis cannot be both 'treated' and 'non-treated' at the same time. This is commonly called the attribution problem. This challenge is at the core of the methodological discussion in the following sections, as it must be addressed when developing and implementing the methodological approach for a monitoring and evaluation system (Peters 2009, Reade 2008, Leeuw and Vaessen 2009: 21-34).

There are three common comparison approaches for tackling the attribution problem (Bensch et al. 2011, Peters 2009). They are built on a baseline or a comparison group, or both. A baseline describes the situation prior to the development intervention, against which progress can be compared through measurement at a later point in time. Another approach to attribute results is to use a comparison group that has the same characteristics as the treatment group, but is not treated by the development intervention. Each approach is based on certain assumptions and needs to fulfil particular prerequisites to isolate the net effects (Bensch et al. 2011: 10):

1. The simple before-after comparison collects information on the treated units of analysis before and after the intervention. The baseline is used as the counterfactual. To isolate the net effect, no underlying trend in the relevant Outcome variables is assumed to exist that would not otherwise have occurred, even in the programme's absence.
2. The cross-sectional comparison observes treated and non-treated units of analysis once, at a specific point in time. The comparison group is used as counterfactual, and connected and unconnected entities are assumed not to differ systematically in terms of unobserved characteristics, which could influence the relevant Outcome variables.

3. The double-difference or difference-in-difference approach collects information on treated and non-treated units of analysis before and after an intervention. The changes in Outcome variables in the comparison group are the counterfactual. The underlying trends for both the treatment and the comparison group are assumed to be identical.

In general, the double-difference approach allows for the most reliably attributable results measurement (Reade 2008: 15, Bensch 2011: 12). However, statistical accuracy is only one criterion in deciding on the methodological approach. A workable M&E system also has to consider the practicalities of, and the effort expended in, data collection and analysis.

Hence, approach selection is based not only on theoretical considerations, but also on aspects of feasibility. Whereas the double-difference approach allows for the most reliable results attribution, its implementation costs are correspondingly high. For instance, it requires twice as many individuals to be interviewed. Furthermore, identifying an appropriate comparison group might not always be possible. In such situations, a simple before-after or a cross-sectional comparison can be more appropriate, even though they have some limitations at the interpretation level.

Finally, in addition to the decision on the general approach, the type of tools – quantitative or qualitative – to be used to collect the required information must also be defined. Quantitative tools have the advantage of numeralising programme-induced changes, and they permit rapid processing of large quantities of data. Qualitative tools are preferable if a quantitative assessment is not appropriate, or not practical, or if there are complex interrelations to be analysed. However, qualitative tools are more demanding in terms of time and capacity resources, especially if results need to be representative for large population sizes. In such situations a combination of both approaches can efficiently produce complementary perspectives on processes and causes of changes (Leeuw and Vaessen 2009: 21-34).

3.4 Sampling approaches

The units of analysis are the actual subjects of study (e.g. households). Study findings and statements should relate to these units. In many cases these units of analysis are also interviewed to collect the relevant information directly. However, the studied parent population is often too large to be manageable, and only a selected subset, a sample, can actually be included into a survey design. Statistical accuracy can be assured if the sample is representatively drawn from the whole parent population

(Kromrey 2002: 264). The representativeness condition is met if the sample reflects the various attributes of the population in miniature form (Kromrey 2002: 269).[5]

Sampling methods

An appropriate sampling method has to be selected to identify a representative sample of the parent population under study. Generally, the highest statistical validity is achieved if the sample consists of randomly selected units (BFS 2009). In random sampling each unit of the parent population has a definable chance of being selected for the sample (Kromrey 2002: 284-302).

The major advantage of random sampling is that it allows valid conclusions to be inferred from a sample to a population (BFS 2009). Generally, the larger the sample size the better will be the correlation between the sample statistics and the parameter of the population. Furthermore, as the law of large numbers is applicable to probability samples, statistical inference calculations are possible.

To select entities directly from the studied population, a list, or sampling frame, is required. Often such a list is not available, and thus methods have been developed to enable random sample selection in these cases. One method is the random walk (or route selection). Individuals or entities are selected based on a precisely defined procedure on how to walk through a defined area, and thus the randomness of the sample selection can still be ensured (Kromrey 2002: 300).

If the parent population under study is distributed over a large geographic area, simple random selection becomes impractical. And even if there were a list available from which units could be randomly selected, approaching those units would be too costly and time-consuming. Hence more complex random selection methods have been developed. One of those is multistage sampling, whereby several stages of sampling are applied. In the first step, the total population is subdivided into clusters, for instance according to geographical characteristics or administrative units. In the second step only some of those clusters are selected; the actual sample will be drawn from these. In some cases more than two steps may be required to reduce the scope of sample selection. Finally, in the last step, the individuals for the sample are selected randomly, either by means of the random walk as described above or, by random selection from a list (Kromrey 2002: 299).

Once the general sampling method has been defined, there is still one methodological issue to be considered, depending on the study design. If the study includes several implementation cycles, sampling units can be entered at random into the sample

5 For more information on sample requirements to allow conclusions to be drawn on a population under study from a surveyed subset, see e.g. Kromrey (2002: 268 after Friedrichs 1982: 125).

each time, or data can be collected from the same units repeatedly. If data is collected repeatedly from the same entities, the sample is called a panel (Kromrey 2002: 68). Panel surveys are advantageous if changes in the same individual entity are to be assessed over time. However, it is important to select a larger initial panel size as this is necessary to account for the frequently observed omission of panel units, the panel mortality, over time (Kromrey 2002: 526).

Defining the sample size

The optimal sample size is a balance of the desired accuracy of the estimates, e.g. the sample mean μ, and financial, time and human resources of the study (Bortz and Döring 2006: 419). Generally, the higher the desired accuracy the higher the required sample size and thus the implementation cost.

Generally, to determine the sample size three criteria need to be specified. Firstly, the level of confidence[6] $(1-a)$ or the level of significance (a) respectively has to be determined. Alpha is typically set at five per cent and refers to the probability that an Alpha error[7] occurs in statistical analysis. The level of confidence determines the probability that the sample statistic will have the true population value. Secondly, the level of precision or also called the range of the sampling error ε needs to be defined. The latter refers to the at most tolerated range of error in the estimated parameter values.[8] Thirdly, the degree of variability in the measured attributes or, the distribution of attributes in the population needs to be looked at. The less variable the attributes within a population are, the smaller is the required sample size. A level of 50 per cent (0.5) indicates the greatest level of variability in a population and is often used to determine a conservative sample size (Israel 1992).

To determine the sample size for the mean for a infinite population the sample size can be calculated by applying the following formula:

$$n_0 = \frac{Z^2 \delta^2}{\varepsilon^2}$$

If the population size is smaller or finite this formula needs to be adjusted to:

$$n = \frac{n_0}{1+\frac{(n_0-1)}{N}}$$

6 Also called risk level.

7 Alpha error (also type I error) occurs if a test falsely rejects a true hypothesis.

8 Example: with a range of error of ±5 per cent and a level of confidence of 95 per cent, there is 95 per cent certainty that the population mean lies within the range of the sample mean of ±5 per cent.

Thereby, n_0 is the sample size for an infinite population, n is the sample size for a finite population, δ^2 is the estimate of the population variance[9] and, ε is the sampling error. If a standard normal distribution is assumed for the variables, the value for z refers to the area under the normal curve (Israel 1992 following Cochran 1963: 75).[10]

9 A good estimate of the population variance is often not available and, moreover, each attribute typically has a different variance. Therefore, using the formula to calculate the sample size for proportions is often preferred as it results to more conservative sample sizes. In this case the formula reads $\mathrm{n}_0 = \frac{\mathrm{Z}^2\mathrm{pq}}{\varepsilon^2}$ and p is the proportion of an attribute in the population and q is $1 - \mathrm{p}$ (Israel 1992 following Cochran 1963: 75).

10 For example, an α level of significance of five per cent translates to $\mathrm{D(z)} = 0.95 \rightarrow z = 1.96$ and for one per cent to $\mathrm{D(z)} = 0.99 \rightarrow z = 2.58$.

4 Conceptual Design

The M&E framework has been evolved through an iterative process over time. This has allowed for the development of a manageable, feasible, and methodically sound M&E framework, which also aligns with current international debates on the topics of rural electrification, access to energy services, and results orientation. The M&E framework presented here consists of three sections:

1. a conceptual section: based on the programme results chain, this defines the beneficiaries, impact hypothesis and indicators (I–4);
2. a methodical section: this describes the data sources and tools used, results attribution, and the sampling approach (I–5);
3. a process section: this defines the implementation phases, roles, and responsibilities (I–6).

Beside the inherent rationales and requirements of these framework components, two other elements have strongly influenced the process of development and definition, as follows. (1) Subject literature, experience gained in examples of international good practice, and expert knowledge have all been used as reference material and as a basis for cross-checking the approaches developed. (2) The SLE team gained a great deal of practical implementation experience during the three-month stay in West Nile. This knowledge has been repeatedly used to adapt the M&E design to local requirements and to demonstrate its implementation feasibility.

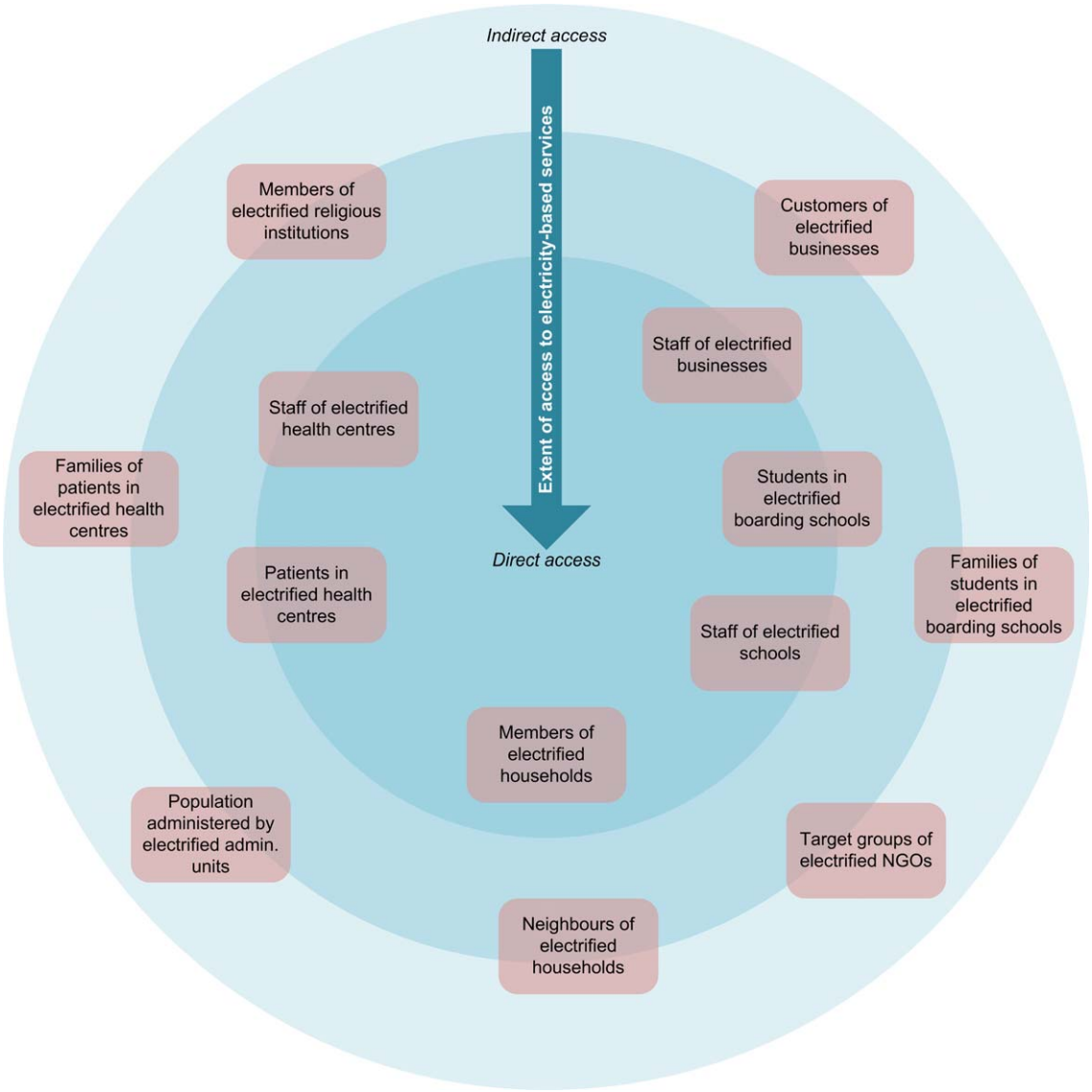
The programme target has been used as a starting point for developing the conceptual design. This target is the improved access to, and use of, broad-based, environmentally friendly and efficient electricity-based services, with the overall goal of contributing to environmentally friendly socio-economic development in West Nile. But as has been shown in the previous chapter, access to electricity-based services needs to be understood as a continuum, with many different degrees and levels of access. Accordingly, first the programme beneficiaries are discussed (I–4.1), after which the programme results are described (I–4.2) and these are then used to define a comprehensive set of indicators for each result level (I–4.3).

4.1 Identification of beneficiaries

Within the electrified area, electricity-based services are accessible to the whole population – for either direct or indirect use – to varying degrees, as shown in Figure 2. The extent of access differs among the beneficiaries for each electricity-based service. The M&E framework therefore considers both individuals with direct access and those with indirect access. In practice, it is not possible to allocate an individual specifically to either a direct or indirect access group, as in reality every individual is

simultaneously touched in multiple ways and to varying extents. Hence a precise distinction between direct and indirect beneficiaries is not feasible.

Figure 2: Extent of access to electricity-based services



In order to assess and report on quantitative results, careful definition of beneficiaries is required. In theory, simply focussing on households might suffice, especially if the aim is to measure results on the population. But to ensure Outcomes are adequately measured and to achieve better results attribution, it makes sense to focus in addition on those institutions that are particularly relevant for the programme goal of contributing to socio-economic development. In accordance with international good practice and the joint programme proposal of the electrification programme, we have thus selected four groups of beneficiaries to be covered by the M&E framework, namely households, businesses, educational institutions, and health centres.[11]

11 These four groups serve as units of analysis and at the same time as principle sources of information for assessing the programme's Outcome and Impact (see I–5.1).

In monitoring an investment programme for rural electrification, the direct results of tangible investments in setting up a power grid can be measured at the Use of Output level (see I–4.2) by counting new grid connections for households, businesses, schools, and health centres. Of the four beneficiary groups under study, we provide a calculation model for a quantitative estimation of the number of benefiting people in the case of households only. A parallel calculation of beneficiaries for the other groups is problematic; as such numbers will always overlap. The same person may live in a connected household, use a school or health station that has electric power and also be employed by, or buy products from, an electricity-using business.

While it is easy to count newly connected customers, it is much more complicated to measure the degree or extent of newly gained access to electricity-based services for the whole population of the electrified areas. As a consequence a different approach is followed to measure the programme results at different levels.

Households and businesses in the electrified areas are selected for the survey at random, regardless of whether they are connected to the grid or not. Since the electrification programme aims at broad-based access and results, this approach allows average changes in access for the electrified areas to be measured.

To summarise, beneficiaries are addressed based on three different approaches (A), (B) and (C) as shown in Table 2. The detailed methodical approach is explained in I–5, while Annex 3 explains how the institutions are counted in detail.

Table 2: Overview of beneficiary groups and measurement approaches

	(A) Number of institutions connected to the grid	(B) Number of people reached by the connected institutions	(C) Average results in the electrified areas or for connected schools and health centres
Households	Number of households connected (with own or sharing a meter)	Number of directly and indirectly connected households multiplied by the average household size of 5.2 (UBoS 2010)	Average values of connected and not connected households in electrified areas
Businesses	Number of connected businesses (with own or sharing a meter)	Not calculated	Average values of connected and not connected businesses in electrified areas
Schools	Number of primary, secondary, and vocational schools and universities connected	Not calculated	Averages values of connected secondary schools
Health centres	Number of all connected health centres (levels II, III, IV and V)	Not calculated	Average values of connected health centres at levels III to V only

4.2 Mapping programme results

The M&E framework is founded on the programme's results chain. Based on that results chain, risks to the success of the programme have been identified together with the potential positive and negative side effects of programme implementation and a comprehensive impact map has been developed (see Annex 4). Based on that impact map, an enhanced results chain has been evolved. This combines various insights: the results expected by KfW, general conceptual considerations of rural electrification, methodological reflections, and ideas adopted on the basis of practical experience.

Four results level have been conceptualised within the results chain (see Figure 3), which encompasses the rationale of the entire electrification programme in West Nile. Each results level has its own distinct focus on expected results, and hence requires a separate reasoning for its indicators.

The Output level is concerned with the completion of programme activities, such as the rehabilitation and construction of infrastructures, as well as the GIZ measures which relate to electricity demand and to the awareness of its safe and productive use.

At the Use of Output level, the M&E framework focuses on the intermediate results directly deriving from the Output level, for both electricity supply and electricity demand. On the supply side, the provision of reliable and affordable electricity by WENRECo is a matter of interest, whereas the demand side is captured by monitoring the results of the GIZ measures, most notably the resulting degree of awareness within the population.

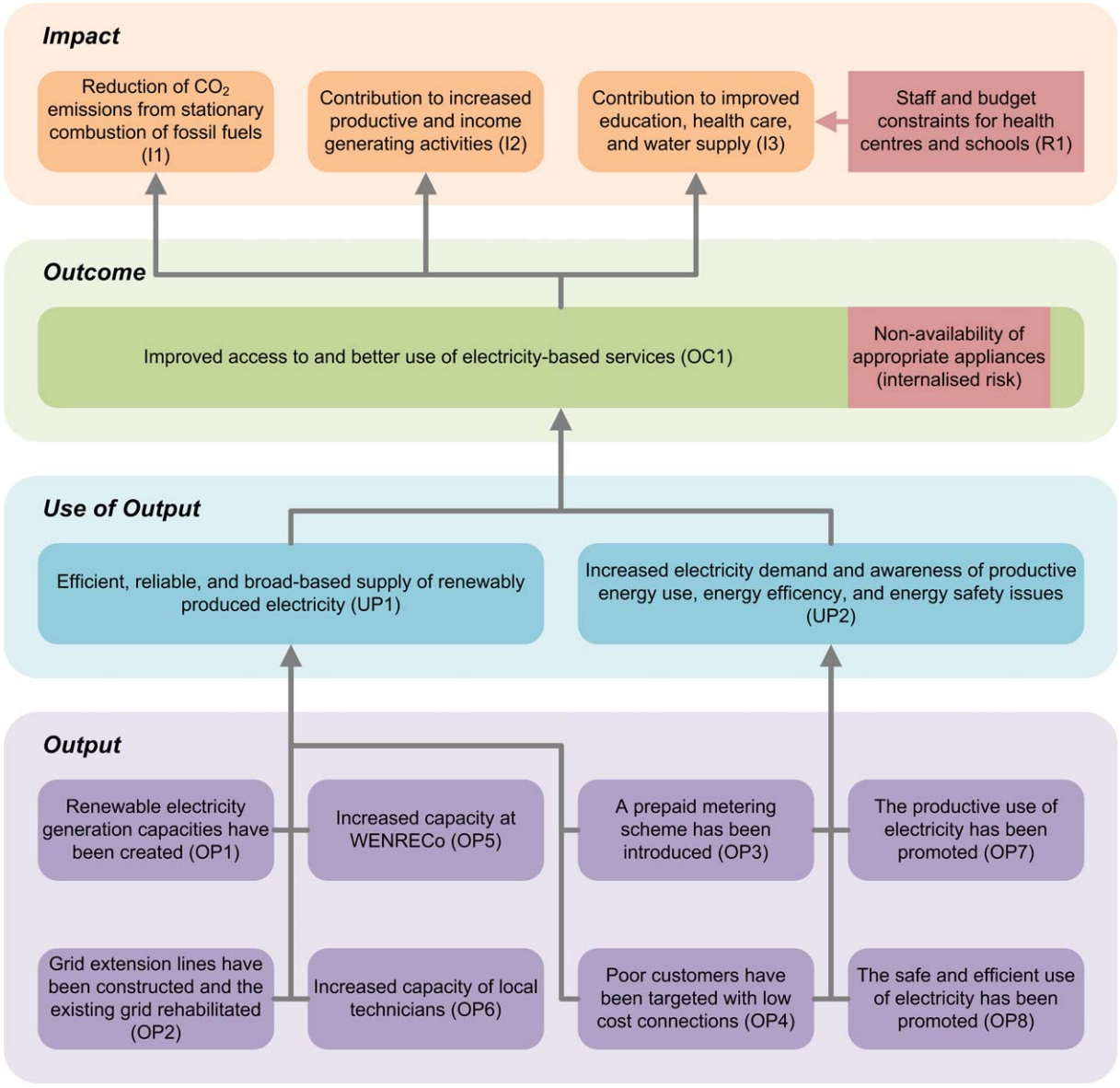
The Outcome level embeds the supply of, and demand for, electricity within the concept of access to electricity-based services. The Outcome level is a particular feature of a results-based M&E framework. By putting direct and indirect users of electricity-based services at the centre of observation, the M&E framework allows results to be traced progressively, both for users connected to the grid and for non-connected users who benefit from the provision of electricity-based services within the electrified areas and thus have indirect access to electricity.

Finally, the Impact level assesses results that are induced by an improved access in the electrified areas. The reduction of CO_2 emissions, an increase of productive and income-generating activities, as well as improved educational and health services or water supply in West Nile are all indirect positive results expected from the electrification programme. These results are only partially attributable to the electrification programme, because external variables may have a strong influence on their attainment.

Figure 3 presents the results that are anticipated from the investment programme. Each expected result is pictured in a box, which is assigned to its specific result level.

A major external risk to the achievement of the results on Impact level is also displayed (red box). The codes (e.g. OC1, UP2) allow for easier reference in the indicator sheets (see III–2).

Figure 3: The enhanced results chain



4.3 Defining programme indicators

In order to make changes measurable at each of these results levels, indicators have to be designed for all the results identified. Indicators should be precise, capable of providing relevant information, and measurable with a justifiable degree of effort. Each indicator comprises several data elements that need to be collected. In order for the M&E system to be both relevant and practical, it is important to find a good balance between precise measurement of results (many indicators) and manageability (few indicators). This section provides an overview and discussion of the core results and their respective indicators within this M&E framework, arranged by result level.

Results level: Output

The Output level is comparably straightforward, as it results from clearly defined programme activities. Since the 14 indicators on this level only measure whether the outputs have been completed or not, they are not discussed further in this chapter, but are listed in Part III.

On the supply side, KfW is investing in the creation of electricity generation capacity (OP1), in grid extension and rehabilitation (OP2), in a prepaid metering scheme and connections for poor customers, together with GIZ-supported promotion campaigns (OP3 and OP4), and in several capacity development activities (OP5 and OP6). These investments are accompanied by measures, which address the demand for and use of electricity by customers. To this end, KfW has engaged GIZ to carry out awareness campaigns and provide training for current and potential electricity customers (OP7 and OP8). The expected results at the Output level are:

- (OP1) Renewable electricity generation capacities have been created
- (OP2) Grid extension lines have been constructed, and the existing grid rehabilitated
- (OP3) A prepaid metering scheme has been introduced
- (OP4) Poor customers have been targeted with low cost connections
- (OP5) Increased capacity at WENRECo
- (OP6) Increased capacity among local technicians
- (OP7) The productive use of electricity has been promoted
- (OP8) The safe and efficient use of electricity has been promoted

Results level: Use of Output

At the Use of Output level, there are two principle results, which are monitored. On the supply side, these describe how the outputs are utilised by WENRECo. On the demand and awareness side, they describe how the outputs are absorbed by the electricity customers. We developed eleven indicators to measure these two main results. Table 3 provides an overview of the results and indicators.

The supply of electricity by WENRECo is an essential precondition for the entire results chain. Results at the levels of Outcome and Impact can only be achieved if electricity is supplied in an efficient, reliable, and broad-based manner. But the electricity supply in West Nile can only be assured if WENRECo is operating profitably. For this reason, the efficiency of the electricity supply is kept under observation. While WENRECo cannot generate and distribute electricity on a cost-covering basis at present, this is expected to change once technical and commercial losses have been reduced and the hydropower plant starts its operation. This latter development

is in line with the programme's aim of substituting fossil fuels used in electricity generation with alternatives, in order to reduce CO_2 emissions.

Table 3: Use of Output indicators

Result	Indicator
(UP1) Efficient, reliable, and broad-based supply of renewably produced electricity	(UP1.1) a) The number of households, businesses, health centres, and schools with a physical connection to the island grid and b) the proportion of connections in rural areas and c) the proportion of connections for poor households has increased
	(UP1.2) WENRECo has reached break-even point
	(UP1.3) WENRECo has reduced its technical and commercial losses and its collection rate
	(UP1.4) The proportion of electricity produced from renewable energy sources in the island grid has increased
	(UP1.5) The proportion of blackout hours and load shedding in the island grid has decreased
	(UP1.6) WENRECo's maximum response time for blackouts and customer complaints has decreased
	(UP1.7) The proportion of WENRECo customers on a prepaid tariff has increased
(UP2) Increased demand for electricity and greater awareness of productive energy use, energy efficiency, and energy safety issues	(UP2.1) Increased demand for electricity from the WENRECo grid
	(UP2.2) Increased awareness of the potential for productive energy use through the use of electrical appliances
	(UP2.3) Increased awareness of energy efficiency measures
	(UP2.4) Awareness of electricity safety issues in households and businesses

Even though a private company has to turn a profit, WENRECo has been commissioned as an intermediary to ensure the widespread supply of electricity in West Nile, including connections for poor and rural customers. Therefore, the M&E framework covers the number of new connections in towns and rural areas, so that statements can be made on spatial distribution as well as on the number of low-cost connections, which are provided to poor people in the region. In addition, prepaid metering can provide a bridging technology for poor people, allowing better control over their consumption of (and hence their expenditure on) electricity.

Grid connections and prepaid meter installations are technical preconditions, which provide no indication of the quality of the electricity supply. As mentioned in I–3.1, electricity supply in rural areas is often of low quality, e.g. blackouts or brownouts due to poor distribution infrastructures. Therefore the monitoring scheme considers the number and durations of blackouts and WENRECo response times, if outages occur.

This is of particular interest to commercial customers since they require a reliable supply to plan their investments in machines and equipment.

An increased electricity demand and an awareness of its productive, efficient, and safe use are the intermediate objectives of the GIZ measures (UP2). The M&E system captures the general demand among the units of analysis by monitoring the number of applications for an electricity connection. The three awareness components described above are assessed by direct reference to the beneficiaries, according to their degree of awareness with regard to the respective GIZ measure. However, when the M&E framework was developed the GIZ measures had not been finally designed, and hence the indicators here have been formulated as a generic proposal.

Results level: Outcome

The Outcome level is of particular interest, since it describes the programme's main goals. The concept of access to electricity-based services entails a comprehensive understanding of potential results, which goes beyond counting connections to the grid. That concept has been internalised within the results chain as improved access to and better use of electricity-based services (OC1). Such an approach reflects the graduations in access to electricity-based services, and includes beneficiaries who are not directly connected but still benefit from the electricity-based services provided in the electrified areas. In order to benefit from grid electricity and to identify potential barriers on the beneficiaries' side, the M&E system has to consider the affordability, availability, and reliability of electricity-based services.

Monitoring the simple availability of electricity to a defined target group is relatively straightforward. It can be achieved by counting and calculating the beneficiaries with direct connections to the grid, as per indicator OC1.1. However, to measure the improvements in access to and use of electricity-based services, six further indicators are proposed (as specified in Table 4), leading to increased monitoring efforts. But monitoring access in this way not only provides a much clearer picture of the results achieved; by reducing the distance between Outcome and Impact, it also supports more informed discussion and better results attribution.

When assessing Outcome level, a general challenge remains: as described in I–3.1, users of electricity-based services have individual expectations and perceptions, depending on their specific situation. Thus, it is difficult to develop qualitative indicators for such a multidimensional concept as 'access' from interviewees' descriptions of the perceived availability, affordability, and reliability of the electricity-based services that they use. However, with the set of indirect indicators proposed, the changes of access can be properly assessed.

Table 4: Outcome indicators

Result	Indicator
(OC1) Improved access to and better use of electricity-based services	(OC1.1) The number of beneficiaries who are directly connected to the electricity grid has increased
	(OC1.2) In electrified areas, the average number of electrical appliances used in households, businesses, schools and health centres has increased compared to business-as-usual
	(OC1.3) In electrified areas households, businesses, schools and health centres have reduced their fossil energy consumption and their use of biomass compared to business-as-usual
	(OC1.4) In electrified areas, the number of households and businesses that are not able to pay for their monthly electricity consumption from the island grid remains low
	(OC1.5) Households in electrified areas are better able to satisfy their ICT service needs compared to business-as-usual
	(OC1.6) In electrified areas, accidents caused by electricity use which lead to serious injuries, death or property damage have reduced compared to business-as-usual
	(OC1.7) In electrified areas, electricity-saving measures implemented by households and businesses have increased compared to business-as-usual

Indicator OC1.1 calculates the number of people living in households that are connected to the grid (see I–4.1), while the other six indicators describe the benefits for both connected and unconnected households and businesses, as well as for connected secondary schools and health centres.

The actual use of electricity-based services is of particular interest and is therefore specifically monitored by indicator OC1.2. End-use appliances play a key role by transforming the electricity provided into useful services. We therefore consider the number of appliances as a convenient indicator: if more appliances are in use, then access to these services has obviously improved. A major risk to the achievement of the Outcome therefore lies in the availability of affordable, easy-to-maintain appliances of adequate quality. This risk is partially included within the monitoring of indicator OC1.2. However, as this risk also contains qualitative aspects, it is proposed to complement indicator OC1.2 with qualitative evaluations if the number of appliances proves to be significantly lower than expected (see I–6.2).

If access to competitive electricity-based services is improved, it can be expected that this will substitute for the use of other energy sources, such as biomass or fossil fuels. Thus indicator OC1.3 serves to assess the amount of fossil fuels and biomass

combusted. A higher degree of access to electricity-based services can be assumed if both are used less when compared to the baseline.[12] It is possible that a reduction in biomass or fossil fuels may be caused by external factors (e.g. an economic downturn in the region or a drought). However, that factor can be controlled methodologically through the double-difference approach (see I–3.3, I–5.1, and I–5.2).

The affordability of electricity-based services was primarily discussed in the general context of lower expenditures on energy sources. Since services powered by grid electricity are typically cheaper than fuel-based services, lower overall expenditure on energy could be expected.[13] But in reality expenditure could stay the same, or might even rise due to an increasing service demand. Affordability is therefore assessed indirectly, by monitoring the extent of use (indicators OC1.2 and OC1.3). This is backed up by indicator OC1.4, which tracks the number of unpaid electricity bills. If this number stays low and the number of connections and extent of use increases, it is reasonable to assume that the electricity being supplied is affordable.

As well as substituting for other energy sources and making energy services competitively priced, electricity may also serve as a foundation for the provision of new services which are entirely based on electricity, most prominently ICT-related services. OC1.5 monitors improvements in access to electricity-based information and communication services, for both direct and indirect beneficiaries.

Finally, an improved access to electricity-based services should also consider the reliability of both the electricity supply and the electrical appliances used. However, the quality and reliability of appliances is beyond the programme's influence, and thus not part of the monitoring. The reliability of the electricity supply, in contrast, is already captured at the Use of Output level.

The GIZ measures, which aim at improving productive, safe and efficient electricity use, are reflected in the indicators OC1.6 and OC1.7. While at the Use of Output level the measures have been assessed in terms of knowledge, the Outcome level quantifies the GIZ measures in terms of the degree to which their content is adopted in practice. The number and type of electrical appliances and machines in use also provides some insights into productive activities (OC1.2).

12 The substitution of biomass (especially for cooking) is discussed controversially (see next footnote); however the monitoring of the share of households that use biomass as fuel will possibly shed some light on this issue.

13 While this is true for lighting and mechanical power, it cannot be generalised to cooking, as in rural areas firewood is often collected and not purchased.

Results level: Impact

Once access to and use of electricity-based services has been improved, positive results for both (local) economic and social development (I2 and I3) as well as a reduction in CO_2 emissions (I1) can be expected at the Impact level. Any results assessment has to consider that results on that level are not directly linked to KfW's investments, and are therefore not influenced by the electricity programme alone. However, it is possible to attribute certain results by applying the double-difference approach, and to identify indicators, which observe electricity-induced results for the beneficiaries. Table 5 summarises the Impact results and risks, as well as the ten indicators, which have been developed.

Table 5: Impact indicators

Result	Indicator
(I1) Reduction of CO_2 emissions from stationary combustion of fossil fuels	(I1.1) CO_2 emissions from the stationary combustion of fossil fuels for grid electricity generation have been reduced in both absolute and relative terms
	(I1.2) In electrified areas CO_2 emissions from the stationary combustion of fossil fuels have been reduced compared to business-as-usual
(I2) Increased productive and income-generating activities	(I2.1) In electrified areas, businesses have expanded their productive and commercial activities in terms of number of employees and length of business hours compared to business-as-usual
	(I2.2) In electrified areas, productive activities have increased, in terms of the proportion of lines of businesses which have local value adding
	(I2.3) In electrified areas, the share of households with income-generating activities in general and the lines of business with local value adding have increased compared to business-as-usual
(I3) Contribution to improved education, healthcare, and water supply	(I3.1) In electrified areas, the proportion of secondary schools providing electricity-dependent educational services has increased compared to business-as-usual
	(I3.2) In electrified areas, both (a) the proportion of health centres (level III and above) that offer key electricity-dependent health services, and (b) the proportion of such health centres that are able to provide such services whenever they are needed, has increased compared to business-as-usual
	(I3.3) The average number of customers of central water providers and the reliability of water supply in electrified areas has increased compared to business-as-usual
(R1) Staff and budget constraints for health centres and schools	(R1.1) The proportion of connected health centres quoting budget constraints or the non-availability of qualified staff as the main bottlenecks which prevent the delivery of some key health services remains high
	(R1.2) The proportion of connected schools quoting budget constraints or the non-availability of qualified staff as the main bottleneck which prevent the delivery of some educational services remains high

It proved impractical to quantitatively monitor the results on income generation at household level. Since households are highly diverse in their sources of income as well as their energy demands and energy service uses, it is not really arguable to attribute changes in their income (direct) or expenditures (indirectly) to the electrification programme. However this issue is still included in the questionnaires, and it is recommended that this additional data gathered during the monitoring cycles be used as a basis for evaluation (see I–6.2 and I–6.3).

For result I1, (non-transport) CO_2 emissions are calculated both for the energy supplier WENRECo (I1.1) and for the population (I1.2). Emission reductions can be expected for WENRECo because present electricity generation, which is based on heavy fuel oil and diesel, will be supplemented, if not largely replaced, by hydropower. Emission reductions can be expected for the population because most energy services in West Nile are fuel-based. With a switch to electricity-based services, the reduction of fuel-based emission can be attributed to the programme intervention. However, only fossil fuels are considered for emission reductions, as there is no reliable data on the sustainability of the biomass used in West Nile, and the collection of such data is not feasible in the context of the monitoring process (see Annex 5 for a detailed explanation of how to calculate CO_2 emissions).

The contribution to productive and income-generating activities (I2) is measured by the increased number of employees and extended business hours (I2.1), the increased proportion of businesses with local value-adding (I2.2), and the increased proportion of households with productive activities (I2.3). Of course, the increase in productive and income-generating activities is not solely dependent on the use of electricity-based services, but is also influenced by other factors, which are outside the programme's scope. Nevertheless, the hypothesis underlying the results chain assumes that productive activities can be stimulated and their efficiency can be increased if businesses and households are able to reduce their total expenditures on energy and gain access to new ranges of products, services, and markets. Such an increase in productive activity can be then attributed to the programme intervention, based on the double-difference approach.

With regard to social infrastructures, the results of electrification are expected to improve the delivery of services. Health centres and schools not only have access to key electricity-based services, but are progressively incorporating them into the range of health or educational services they provide. Again, three dimensions of access are highly relevant at this level, and each will be monitored. Given that health centres and schools have access to electricity and can make use of it, the services provided must still be reliable and available as and when needed by patients or students alike.

Improved education, healthcare, and water supply (I3) are thus measured mainly in terms of the services that are offered in these fields (I3.1 to I3.3). A major risk to achieving the Impact results lies in the inadequate volumes of qualified staff and budgetary funds available to the respective social services (R1). This is measured by indicators R1.1 and R1.2 for schools and health centres respectively.

Access to clean drinking water is considered an important element in improving the rural health situation. Water supply is often limited by the costs of water pumping, which are particularly high if the pumps are powered by diesel engines. With an increased access to cheap electricity, one can also expect greater access to clean drinking water within the electrified area. Therefore assessing the number of customers of central water suppliers serves to capture quite adequately the reliability of water provision and the range of service provided.

5 Methodical Design

The methodical design describes how the results and indicators outlined in I–4 will be monitored and evaluated. The 14 Output indicators will only be checked on the basis of KfW and GIZ monitoring reports. The seven Use of Output indicators for the supply side focus on the performance of WENRECo. The simple before-after approach is used to monitor these indicators. For the remaining indicators a more complex methodical approach is followed, which is described below. Decisions regarding the unit of analysis, the survey area, the approach for results attribution and the required representativeness provide the methodical base (I–5.1), after which the sampling procedure is explained and a sampling proposal made (I–5.2). Based on these decisions, the data sources are selected and appropriate tools developed (I–5.3). The chapter concludes with a discussion on how the collected data will be processed and analysed (I–5.4).

5.1 Defining the methodical design

In developing the methodical design for the M&E framework, several fundamental questions must be clarified before a detailed design proposal can be elaborated. Because these issues are interdependent, they need to be addressed and discussed together:

- the units of analysis, on which the information which generates the results is collected;
- the parent population, which is represented by the units of analysis;
- the applied approach for results attribution;
- the level of statistical significance required.

Units of analysis

Part I–4.1 has described the beneficiaries of the electrification programme. These beneficiaries are to be the subjects of M&E statements. To carry out the M&E surveys, units of analysis have to be defined. However, the units of analysis are not necessarily identical with the beneficiaries. In the present case, the units of analysis at Outcome and Impact levels are households, businesses, secondary schools and health centres of level III and above.

Several types of educational institutions and health centres that fall within the beneficiary group had to be excluded to maintain feasibility. Both vocational schools and universities have not been considered for the sample as it is difficult to calculate average result values for such heterogeneous institutions. Furthermore, nursery and primary schools have been left out, as the results to be expected for these school

types (with the exception of lighting, which will also be monitored for secondary schools) are quite limited. The same holds true for level II health centres, which offer hardly any energy-dependent health services (Ministry of Health 2009).

Parent population

A precise definition of the parent population is required in order to develop a sampling proposal for the M&E survey. According to the methodical design, the population has to be defined for all units of analysis, and for both the treatment group and the comparison group.

For the treatment group, the parent population of households and businesses can be defined as all households and businesses in the electrification corridor. The electrification corridor can be described by the settlements (towns and trading centres[14]) that will receive a transformer station. As a transformer allows connections up to a radius of 500 metres, only households and businesses within this range can be connected to the grid. The population of secondary schools and health centres of level III and above are simply all of these institutions that get connected to the grid.

For the comparison group, the population of households and businesses is defined as all households and businesses outside of the electrification corridor. The population of secondary schools and health centres of level III and above are simply all of these institutions that are not connected to the grid.

Applied approaches for results attribution

Of the three general approaches for results attribution presented in I–3.3, the double-difference and the simple before-after approach have been selected. The double-difference approach has been implemented for secondary schools and health centres, and also for households and businesses in trading centres. In contrast, the simple before-after approach has been applied for households and businesses in towns. These methodical decisions have been influenced by considerations regarding the survey area, the units of analysis, the required statistical significance, and implementation feasibility.

For the double-difference approach, two different options are being used. The first option compares electrified units of analysis with non-electrified units of analysis, and has been applied to health centres and secondary schools. This is proposed simply because it is expected that all secondary schools and health centres (of level III and

14 Those settlements, which, as district capitals have ‘town council’ status, or else have a minimum of 20,000 inhabitants at the time of this study, are considered towns. All other settlements are, according to common practice in Uganda, known as trading centres.

above) within the electrified corridor will sooner or later be connected to the island grid in West Nile. However, that approach has limitations for electrified households and businesses: they are not generally comparable to households and businesses without grid electricity, because electrification usually favours the better-off (e.g. World Bank 2008). Separating the better-off from the poorer units of analysis, however, poses a substantial methodical challenge, and is hardly feasible within a lean, practical M&E system.[15]

Hence an alternative option to the definition of treatment and comparison group for the double-difference approach has been applied for all households and businesses. Here, all units of analysis both with and without grid connections in the electrified areas are compared with all units of analysis in areas that are not connected to the electricity grid. Since only a limited number of households and businesses will be connected to the grid in the next few years, the average changes in each area will be compared.

While the first approach allows for an easy and more direct measurement of programme results on health centres and secondary schools, the second allows for measurement of indirect programme results on households and businesses by including indirect beneficiaries in the sampling (see I–4.1 and I–4.2).

As all towns in West Nile are supposed to be connected to the grid in the years to come, it is not possible to identify an appropriate comparison group for households and businesses in towns. In addition, the development dynamics and conditions in town areas are considered to be significantly different from those in other areas within West Nile. As a consequence, the simple before-after comparison is applied for households and businesses in towns.

Statistical significance

Finally, a decision needs to be taken with respect to the representativeness desired from the study. As explained in I–3.3, both the level of confidence and the acceptable range of measurement error must be defined. Generally, a study with a level of confidence of 95 per cent is considered statistically significant. For this M&E framework, however, we propose a level of confidence of 90 per cent. This is a value which, in the context of a M&E framework that has limited scientific pretensions, is still perfectly acceptable for practical purposes, and it also results in a manageable sample size. We propose a tolerance of ±5 per cent for the single-sided measurement error, as do most M&E-related surveys in the development cooperation field.

15 Still, if at some point during the M&E process it is desired to draw a clearer picture of the results of electrification for a connected beneficiary compared to one not electrified, this has been catered for.

To achieve the desired level of representativeness, it is necessary to survey 300 households in each survey area (treatment trading centres, comparison trading centres, and towns), which amounts to 900 in total. Furthermore, interviews need to be carried out at 275 businesses in each survey area (825 in total). These numbers are calculated from an estimated population size of 20,000 households and 4,000 businesses in the sampled trading centres and town areas of the electrification corridor, using the data collected during the exploratory trip. This calculation is based on the formula developed in I–3.4. In order to account for a number of flawed interviews, these numbers have been rounded up to a generous extent. This means that in each of the 20 trading centres an average of 30 households and 28 businesses need to be interviewed, while in the towns approximately 50 households and 46 businesses interviews are needed.

Currently there are 95 health centres classed as level III, IV or V in the six districts of West Nile that are covered, together with 170 secondary schools. For the moment, the schools and health centres to be connected have not been conclusively determined. However, as their number will be limited we propose a total population survey resulting in a statistical significance surpassing the intended level.

5.2 Sampling proposal

Based on the considerations above, a specific sampling procedure is proposed. Due to the different characteristics of the units of analysis, sampling procedures vary for households and businesses as against schools and health centres. For each unit of analysis, a sample has to be drawn for both the treatment group and the comparison group.

As specified above, the populations of the treatment group comprise all households and businesses in towns and trading centres that are supposed to receive a transformer, as well as all schools and health centres for which electricity connections are planned. Accordingly, the populations for the comparison group consist of all units of analysis that (due to their physical distance to the grid) will not have the opportunity in the foreseeable future to be connected to the electricity grid in West Nile.

Schools and health centres that are already connected and households and businesses that are located in areas that are already connected to the grid are thus not part of the potential sample. There are two main reasons to exclude the populations that are already connected from the sample. (1) The areas that are already electrified have poor quality electricity provision due to the limited capacities of the diesel generator. The general conditions of electricity supply in the newly connected areas, however, will be significantly different, and thus these two areas cannot easily be compared. (2) Only some of the programme results could be measured cleanly for these areas, since a baseline has not been established before the first electrification

treatment. While it would be possible to measure the results of the GIZ complementary measures or the low-cost connections offered in this area, this can be done just as well in those areas that will be newly connected by the programme.

Households and businesses in trading centres

For households and businesses in trading centres, the double-difference approach has been applied for results attribution. Therefore, units from both the electrification corridor as well as from not electrified areas have to be surveyed. However, it is logistically not manageable to select households and businesses at random from the entire region. Thus, it was necessary to follow a multi-stage sampling approach (see I–3.4), and to group the units of analysis at a first stage into clusters. Geographical classification has been chosen and trading centres and town areas comprise clusters. At a second step, a representative number of clusters has been sampled and within those randomly selected households and businesses will be interviewed.

The electrification programme in West Nile plans to make electricity connections possible in approximately 40 towns and trading centres. For maximum statistical representativeness, as many settlements as practically feasible should be included in the sample. Based on experiences prior to the baseline survey, we propose not to exceed 25 to 30 clusters in the survey, including both the treatment and comparison groups.

These clusters have been deliberately selected to cover the maximum variance between the settlements. Three main criteria have been used for the selection:

- the sample represents all districts of West Nile;
- settlements with different population sizes and economic characteristics are considered;
- for each treatment cluster a comparison cluster can be identified, with similar socio-economic and infrastructural characteristics.

While it is easy to group the settlements according to the first criterion, the other two were more challenging to assess, since they require basic data on the towns and trading centres. In West Nile, however, hardly any statistical data is available for towns, and none at all for trading centres. The data available is disaggregated only to administrative units.[16]

16 There is no administrative unit for a trading centre in Uganda. Many of the trading centres stretch across several villages. Only the bigger trading centres have a proper administrative status as ‘town boards’, which provide a minimum of statistical services (see Annex 1).

It was thus necessary for the SLE study team to conduct exploratory trips to collect basic population and socio-economic data[17] for the trading centres in West Nile before being able to select the settlements to be included in the sample. During this field survey more than 80 trading centres and towns were visited, including almost all trading centres and towns that are planned to be connected to the grid, together with an equal number of locations for the potential comparison group.

Based on the results of this survey (see DA–7) it was possible to group the settlements according to their size, and to see if a settlement within the electrification corridor is comparable to a settlement outside of it. Ten trading centres have been chosen; these best fulfil the three selection criteria mentioned above. The comparison group was derived accordingly. Table 6 identifies the trading centres proposed for the M&E surveys.[18] Their geographic location is displayed in Figure 4. It is recommended to use the same trading centres during the whole M&E process. However, if a trading centre in the comparison group undergoes significant changes, e.g. due to a large-scale solar system programme, the list must be amended (see II–3.1).

Table 6: List of trading centres for the M&E survey

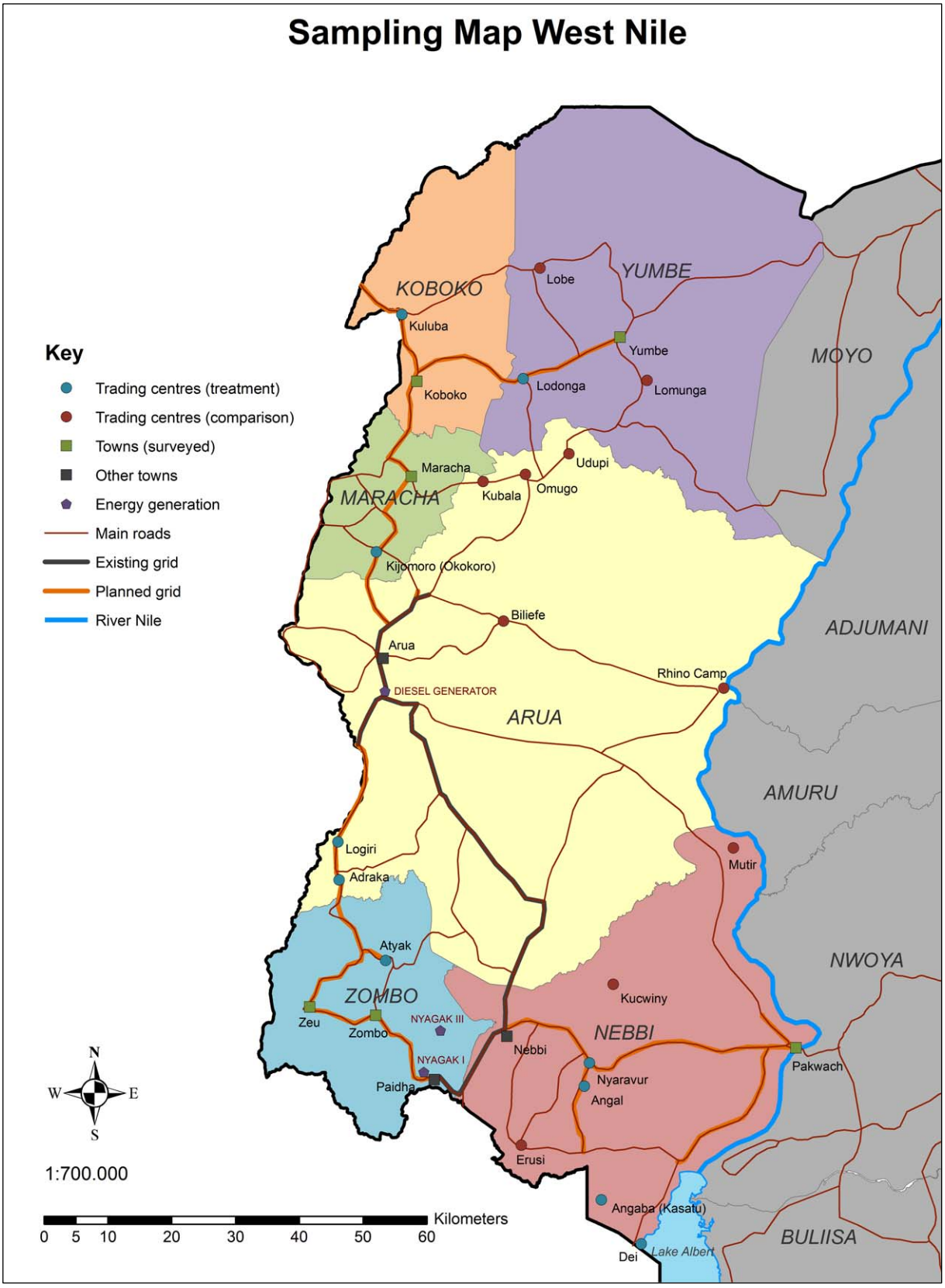
Treatment Group			Comparison Group		
Name	District	Population est.	Name	District	Population est.
Angal	Nebbi	10,000	Rhino Camp	Arua	9,000 – 10,000
Lodonga	Yumbe	4,000 – 7,000	Kucwiny	Nebbi	5,000 – 8,000
Kasatu (Angaba)	Nebbi	3,000 – 4,000	Erusi	Nebbi	3,500 – 6,000
Dei	Nebbi	2,500 – 4,000	Lomunga	Yumbe	2,000 – 3,500
Nyaravur	Nebbi	1,500 – 5,000	Kubala	Arua	2,500 – 5,000
Okokoro (Kijomoro)	Maracha	1,500 – 3,000	Udupi	Arua	1,000 – 3,000
Kuluba	Koboko	500 – 1,000	Mutir	Nebbi	500 – 1,000
Adraka	Arua	300 – 800	Biliefe	Arua	300 – 800
Logiri	Zombo	250 – 400	Omugo	Arua	250 – 400
Atyak	Zombo	200 – 400	Lobe	Yumbe	200 – 300

17 Among other information, data on the following categories has been collected within this field survey: number of inhabitants and households; road type; type and size of market; types and number of businesses; availability of other sources of electricity (generators and PV-systems); distance to/number and type of schools and health centres; number and type of religious institutions; and administrative representation. All of the data gathered has to be considered as a rough estimate.

18 Before starting the baseline survey, it is strongly recommended to verify once more whether the proposed pairs of trading centres are still comparable (see II–3.1 for a proposal on how to conduct such a verification).

A random sample of households and businesses needs to be drawn on the basis of the selected trading centres. As no sample frame is available, selection via a random route is proposed. In DA–12 and DA–13 a proposal for a random route for trading centres is described in detail.

Figure 4: Geographic location of trading centres and towns for the M&E survey



Households and businesses in towns

It was not possible to identify a comparison group for the towns that will be connected (Pakwach, Zombo, Zeu, Maracha, Koboko, Yumbe, see Figure 4). The only towns in West Nile that could theoretically serve as comparison group (Moyo and Adjumani) cannot be selected because there are vague plans that they will be connected to the national electricity grid of Uganda in the medium term. Selecting a comparison group outside West Nile was not an option in terms of feasibility. Thus the simple before-after comparison has been applied for households and businesses in towns.[19] Due to their limited number, we propose to include all of the towns to be electrified within the sample.

Since from the perspective of this M&E framework the main difference between towns and trading centres is the pace of development, it is sensible to concentrate on the dynamic areas of towns for the sampling of the units of analysis. The survey area in the towns has therefore been limited to the town centres.

A random sample of households and businesses needs to be drawn based on the selected town areas. As no sampling frame is available, selection via a random route is proposed. In DA–12 and DA–13 a proposal for a random route for town areas is described in detail.

Health centres and schools

The double-difference approach is also applied to analyse the results for health centres and secondary schools. For these units of analysis, however, the situation is different compared to that of households and businesses, as the overall population is significantly smaller. Currently, there are a total of 95 health centres of level III and above, and 170 secondary schools in West Nile. Around ten health centres and ten schools are already connected and are thus not part of the parent population.

Out of the remaining only a limited number of institutions will be connected. We therefore propose a total population survey for in the future electrified secondary schools and electrified health centres of level III and above.

The comparison group comprises of those institutions that will not be connected to the grid and should be surveyed in a panel. In contrast with the electrified institutions, not all of those which are not connected will be included in the monitoring system, and so an appropriate sample needs to be drawn for these non-connected establishments. As the number here is again small and a sampling frame can be estab-

19 If at the time of the baseline survey these plans are likely to be cancelled, this decision could be reconsidered, which would then theoretically allow for a double-difference approach for some of the towns (which in turn would require an enlarged sample for households and businesses).

lished, a purposive sampling procedure is proposed to identify a group of comparable institutions outside the electrification corridor. The following criteria need to correspond between the treatment and comparison groups:

- distribution of regions (districts) and locations (within and outside of settlements) in West Nile;
- proportion of public versus private health centres and schools;
- proportion of schools of differing sizes (in terms of number of pupils);
- proportion of the different levels of health centres.

A panel of comparable institutions will be monitored on the basis of the criteria suggested. Thus, as well as the additionally connected health centres and schools, an equal number of non-connected institutions will be surveyed during each M&E cycle.

To date, however, a final list of health centres and schools that are to be connected to the grid in West Nile is not available. Thus we cannot propose a definite sample for the comparison group, and until a baseline survey is conducted (see I–6.2) the sample will have to be drawn based on information from WENRECo and the Ministry of Health and Ministry of Education and Sports in Uganda (see II–4 for details on how to obtain this data).

5.3 Data sources and data collection tools

The indicators, which have been developed are supported by data elements clearly defining the information that needs to be collected. The indicator sheets in Part III specify the source for each data element and the tool for its collection. A short overview on the data sources and tools used is provided thereafter.

Data sources

KfW and GIZ will provide most of the required data elements for the Output level through their regular project reports. While KfW can provide information on the construction and rehabilitation of electricity supply infrastructures, GIZ is responsible for reporting on its capacity-building and awareness-raising activities. The electricity provider WENRECo is the main source of information at the Use of Output level, which includes technical data on connections, electricity consumption, and payment methods. It is recommended that WENRECo reports to KfW every six months.

To collect the required information for the Outcome and Impact levels, it is necessary – in addition to WENRECo data – to interview the beneficiaries directly in a field survey. Some indicators need additional data to be collected from other sources, such as the Uganda Bureau of Statistics (UBoS), or local water suppliers. Other data elements must be collected for evaluation and cross-checks (see I–6.3) as well as for

the verification of sampling. Table 7 gives a short overview of the data sources and data tools on each result level.

Data collection tools

The questionnaire is the main instrument for collecting comprehensive primary data for the different result levels. Four standardised questionnaires were developed to obtain information from households, businesses, secondary schools, and health centres. A structured questionnaire to obtain information from the local water suppliers has also been produced. All information from questionnaires needs to be collected during the field survey. The questionnaires are attached in Annex 6 and DA–15-19.

Furthermore, specific data sheets have been prepared for WENRECo, for the required sampling data (lists of trading centres, schools, and hospitals) and for some additional data elements. This data is to be collected during a complementary data survey from the sources stated in Table 7.

Table 7: Overview on sources of information

Result level	Data sources	Data tools
Output	WENRECo, KfW, GIZ	WENRECo data sheet, KfW/GIZ reports
Use of Output	WENRECo, GIZ, households, businesses	Questionnaires, data sheets
Outcome	WENRECo, households, businesses, health centres, secondary schools, UBoS	Questionnaires, data sheets
Impact	WENRECo, households, businesses, health centres, secondary schools, water suppliers	Questionnaires, data sheets
Sampling, evaluation and data cross check	Ministry of Health, Ministry of Education and Sports, UNEB, URA, UBoS, WENRECo	Data sheets

5.4 Data processing and analysis

The proposed M&E framework allows for results-based monitoring and evaluation. Due to the methodical approaches applied, and the various indicators and data elements used, the explanatory power of the calculated results differs in scope across the units of analysis.

For instance, referring to the indicators at Outcome and Impact levels for households and businesses in West Nile, in general three mean values are calculated: for non-electrified trading centres, for electrified trading centres, and for towns.

Mean values for households and businesses in trading centres reflect the varying degree of direct and indirect access to electricity-based services, as well as the diversity of households and businesses. That allows an appropriate illustration against each indicator for reporting on the programme's results. By then comparing the mean value situation in electrified to non-electrified trading centres, the M&E system can describe the net attribution of observed changes to the electrification programme.

For households and businesses in towns, the data values have to be interpreted differently. The programme's results can indeed be presented in the same manner as for households and businesses in trading centres. However, the simple before-after approach applied cannot attribute the results as distinctly as the double-difference approach, due to the lack of a comparison group.

In the case of schools and health centres, a comparison is made only between non-electrified and electrified entities, and their respective mean values are calculated. This allows average changes in electrified schools and health centres to be analysed and attributed to the programme intervention.[20]

However, each M&E survey collects surplus data for disaggregated analysis. If desired, detailed calculations can be made to trace further changes of interest, e.g. on regional disparities or effects on different sizes of trading centres. Furthermore, the design of the questionnaires also allows for comparisons at an individual level, and for the application of more sophisticated statistical tools if necessary. This is ensured by control variables which are incorporated within the questionnaires.

Finally, during the M&E procedures data is also collected for final evaluation instruments. This data can be ignored for the regular monitoring cycles (see I–6.3).

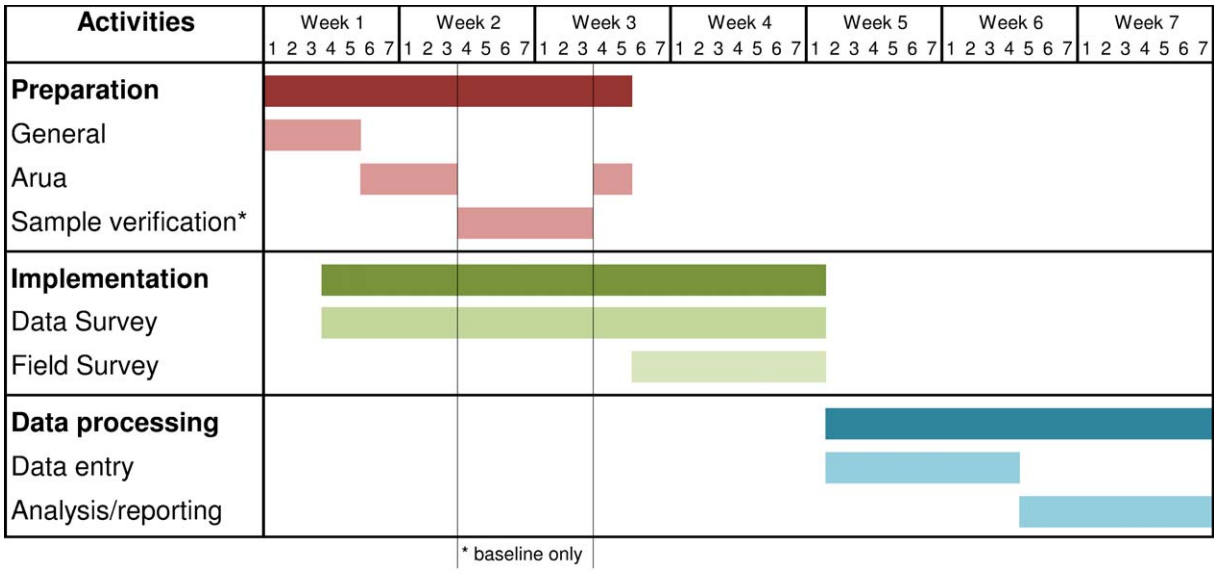
Since detailed analysis of all collected data cannot be conducted during the monitoring cycles and might not be possible even during the evaluation phase, we recommend collaborating with an university to harvest the full potential of the accumulated data stock within an accompanying research project.

20 As the surveyed connected health centres and secondary schools are captured within a total population survey, statistical testing needs to be carried out carefully. For a discussion on the appropriateness of tests of significance and confidence intervals with total population data see for instance Behnke (2007) or Broscheid and Gschwend (2005).

6 Implementation

A results-based M&E framework of the proposed scale cannot easily be implemented alongside day-to-day work. Therefore, it is recommended that KfW engages an external M&E consultant for each M&E cycle who will coordinate the implementation of the M&E process. This should require 42 days every two years and seven additional days for the baseline (see Figure 5) as proposed in II–1.

Figure 5: Implementation schedule of the M&E survey



Nonetheless, all of the stakeholders have their role to play in supporting this process. KfW has to facilitate the work of the consultant, and both KfW and GIZ also need to provide monitoring data on the Output indicators. MEMD and REA should support the M&E process by preparing reference letters, and facilitate the procurement of data elements that are gathered from institutions in Kampala. Furthermore, for the Use of Output level, a substantial volume of data must be provided by WENRECo, which is at the same time an important source of information for details on the status of programme implementation. Part II will add further detail regarding the question of roles and responsibilities within the M&E framework for the electrification programme in West Nile.

The M&E framework is implemented in distinct cycles. We propose a baseline survey, a total of three consecutive monitoring cycles, a final evaluation, and (optionally) mid-term evaluations. It is recommended that the surveys are always conducted in the same period of the year, as harvest cycles and related household income might influence the results. All practical details for the implementation of the M&E assessments are elaborated in Part II. The complete M&E process, from baseline survey to final evaluation, will be conducted over approximately eight years. For the most part, the cycles do not vary from each other. Nonetheless, each cycle has important specifics which are described in the following section.

6.1 Baseline

The first step in a thorough results-based M&E process is the establishment of a baseline. Data for the M&E indicators (see I–4.3) need to be collected at this initial stage in order to allow for a description of the situation before actual programme implementation begins. A baseline is indispensable for both the simple before-after and the double-difference approach.

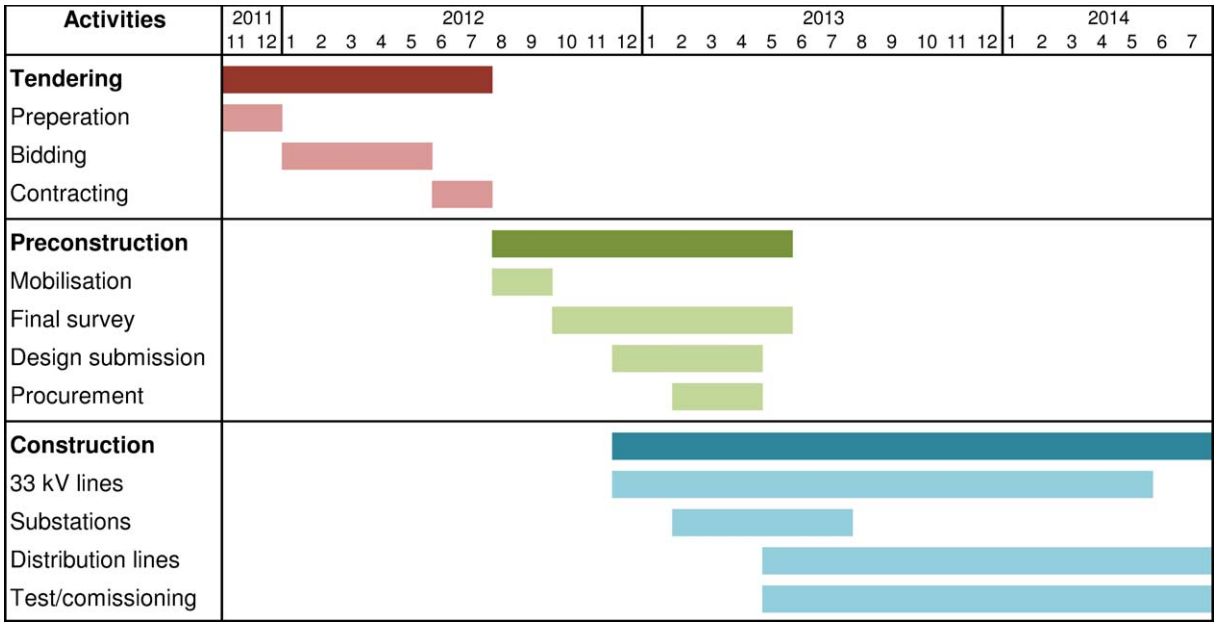
In contrast to the other monitoring cycles, the baseline survey requires a preliminary and a follow-up step. The M&E consultant has to verify the proposed sampling of trading centres as well as conduct the sampling of health centres and secondary schools (see I–5.2) prior to the implementation of the field survey (for a description of the verification steps see II–3.1). After the baseline has been completed and the data has been processed and analysed, target values for the indicators should be agreed upon. As all stakeholders should commit themselves to support the achievement of these targets, these should be developed in a stakeholder workshop. Hence, the baseline survey requires more time than the regular monitoring cycles.

Furthermore, the timing of the baseline is very important for an accurate measurement of programme results. The baseline survey should take place just before programme implementation. This holds true in particular for dynamic regions such as West Nile, with its cross-border trade with the Democratic Republic of the Congo and South Sudan and its rapid population growth. For a programme such as the electrification programme in West Nile, with several components to be implemented in different regions, it can be quite challenging to identify the optimal timeframe for the baseline survey.

In the case of this programme, baseline timing should be aligned with the completion of the grid extension, as results will occur only after the users are physically connected. Based on current planning, tendering for the grid construction in West Nile will not begin before November 2011. This means that the preconstruction phase will start earliest August 2012. First construction could then theoretically begin in January 2013. With testing and commissioning starting four months later in mid-2013, this would be the earliest point at which to start a baseline survey (see Figure 6). However, it seems quite probable that there will be further changes in the timing of the implementation. Therefore the timing of the baseline survey needs to be adjusted to those developments.[21]

21 In fact there are several options for the timing of the baseline survey. In order to be able to assess the short-term results of electrification it is advisable to time the baseline before any of the survey areas are connected to the grid. However, if the programme implementation schedule stretches over a long period of time (six months to a year or longer), it could be more sensible to carry out the baseline survey at the middle of this interval, so that the baseline data will not be out-dated by

Figure 6: Planned installation of the distribution grid (based on Lahmeyer 2011)



6.2 Monitoring

Two years after the baseline survey the first monitoring assessment should be conducted. All of the data for the indicators need to be collected again. Sampling does not need to be re-verified, but has to remain identical to baseline sampling. The monitoring survey should be repeated every two years, for at least three cycles. If there is no progress on one of the expected short or mid-term results, or if unexpected trends are revealed, it is recommended to include qualitative assessments outside the regular monitoring cycle. This could be undertaken within the scope of a mid-term evaluation, for example, or with support from the GIZ while complementary measures are being implemented.

The need for an extra evaluation such as this could arise if the number of electrical appliances in use does not increase. This could have several reasons, such as non-availability on the market at affordable prices, or insufficient quality, which would not be captured in the regular monitoring assessment, but only during the evaluation. In order to reach programme goals, however, it is necessary that the use of electrical appliances does increase. A qualitative assessment such as a focus group discussion or an expert interview could provide important insights as where to intervene, e.g. by means of the GIZ complementary measures to get back on track.

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the time of connection. This, however, would mean that the opportunities to measure short-term results will be reduced. Another option would be to conduct several baselines according to the regional programme implementation schedule (the 'pipeline approach'). This is not advisable, as it makes survey logistics and data analysis significantly more complex.

An interval of two years is proposed for several reasons. Most of the results will only become visible in the medium or long term. Hence, more frequent surveys are not only costly; they will also not provide additional insights. A much longer monitoring interval, on the other hand, will reduce the opportunities to make mid-term results visible. This in turn would reduce the options to steer the programme with the help of M&E and to take strategic decisions based on cause-effect information. Moreover, continuous monitoring information increases KfW's ability to report regularly to the BMZ on the results of the programme.

The data at the Use of Output level is an exception from the monitoring interval, as WENRECo collects and documents this information every six months. This data should be used for operational control of results at this level.

If possible, primary data collected should be cross-checked with other data sources (see I–5.3 for information on data sources). In this M&E framework, some of the primary data collected from the analysis units can be cross-checked with a) data obtained from WENRECo and b) information from national institutions such as the Ministry of Health, Ministry of Education and Sports, UBoS, or URA, as well as UNEB.

The average number of people living in a household demonstrates the importance of cross-checking. This data is obtained through the household questionnaire. However, data collected during the last national census or during national and regional surveys might estimate a different household size (for a list of available socio-economic data and statistics for West Nile see Annex 2). It is suggested that in such cases, a conservative estimate should be used in data analysis.

In some cases secondary data should be cross-checked with other secondary data. For example, this is the case with the number of schools that is used as a basis for data analysis. It should be cross-checked whether the information given by UBoS, the Ministry of Education and Sports, and WENRECo corresponds.

6.3 Evaluation

According to KfW standards, programme evaluation comprises two elements. The first is a final report, which has to be written directly after the end of the investment programme (planned for 2017). The second is an ex-post-evaluation, which is carried out up to five years after programme completion.

The evaluation can be seen as separate yet complementary to the monitoring process. Consequently, it should be conducted after a monitoring cycle has been completed and be based on its results. For this evaluation, the whole programme period starting from the baseline should be subject to analysis in order to allocate results to the programme quantitatively, as provided by the double-difference approach.

Moreover, qualitative research methods are proposed for further insights into programme results. The design of the qualitative parts of the evaluation, however, strongly depends on the monitoring results and must be adapted accordingly. Some proposals can be made here based on the impact map (see Annex 4), which recognises other considerations and potential risks (see Table 8).

Firstly, a number of data elements have been included within the quantitative M&E survey. This data can provide clues to possible long term results, and can thus serve as a starting point for further qualitative research on the contribution of the electrification programme in West Nile to socio-economic, environmentally sound development. These additional data elements capture the following aspects:

- hazardous waste (small batteries, car and solar batteries, electrical appliances);
- the number of businesses in West Nile registered by the URA;
- inflation-adjusted household income/expenditures;
- the average grade achieved by students in the final exams of vocational schools and for Primary Year 7 (after seven years of school) as well as for Senior Year 4 (after eleven years of school) and Senior Year 6 (after 13 years of school) levels;
- the number of treatments carried out in health centres;
- the number of referrals from lower-level health centres to higher-level health centres.

Secondly, derived from discussions on the potential result hypotheses, we have identified fields of interest for a qualitative survey, as shown in Table 8. These could be explored with qualitative methods, such as expert interviews, MAPP[22], or focus group discussions. Furthermore, assessment tools such as poverty score cards[23] could be used in order to gather information on the income situation for households.

Thirdly, it is possible to disaggregate the huge data volume collected during the monitoring to analyse aspects in more detail. Possibilities include individual household comparisons, or the application of income stratification. However, as this implies a substantial expenditure of time, a more in-depth analysis could perhaps be undertaken within the context of a university master thesis, rather than by the M&E consultant himself.

22 MAPP is a participatory impact analysis method developed by the German Development Institute. It is based on group discussions and uses a fixed sequence of six to eight interrelated instruments. It enables stakeholders to identify impacts and to assign them to measures.

23 Poverty score cards for Uganda are available here: http://progressoutofpoverty.org/uganda.

All in all, the final evaluation significantly exceeds the scope of the regular monitoring cycles. On the one hand, the preparatory phase needs to be prolonged to cater for the design of the qualitative study. On the other hand, additional time and resources must be allocated for the implementation of this qualitative study.

Table 8: Fields of interest for the evaluation

Type	Field of interest
Risks to the achievement of programme results	Climate change reducing capacities for hydropower generation
	WENRECo staff leaves company after capacity is developed
	Substantial increase of energy prices or costs of living that reduces the demand for electricity
	WENRECo or the programme loses political support
Possible negative programme side effects	Misallocation of resources due to lack of knowledge of electricity costs, lack of business skills or market access leading to an “electricity trap”
	Migration to areas connected to the grid, leading to reduced quality of life (e.g. through crime or HIV proliferation)
	Widening social gap between connected and non-connected households within the connected areas, and between connected and non-connected areas
	Creation of electricity generation capacities and construction, leading to negative impacts on the local environment
	Increased amount of hazardous waste (e.g. electrical appliances, broken rechargeable batteries)
Possible positive programme side effects	Reduced unhealthy smoke and fumes, leading to reduced lung and respiratory tract diseases, as well as to reduced eye irritation
	Time gained by reduced need to travel long distance to access electricity-based services
	Improved quality of life and social prestige
	Reduced amount of hazardous waste (e.g. batteries)
Exemplary aspects of the results chain, where a qualitative assessment is recommended	Reasons for non-availability of appliances
	Reasons for a limited amount of applications for connections
	Poor quality of appliances

Part II

M&E Manual

Contents

1 Introduction

Having presented the M&E framework in Part I, Part II has been compiled as a practice manual. This manual serves as a guideline for the consultant, who will be chiefly responsible for conducting the monitoring and evaluation process. General instructions and recommendations for the use of this manual are set out below, followed by an outline of M&E activities and the resources required for their implementation.

1.1 How to use this manual

The manual is divided into six chapters. Each chapter describes a set of key tasks necessary for the preparation and implementation of a complete M&E cycle, including data processing and reporting. The manual begins with the preparations that the M&E consultant has to carry out before travelling to West Nile (II–2) and while based in Arua (II–3). The main implementation steps – the data survey and the field survey – are described in II–4 and II–5. II–6 guides the reader through the field data entry process, and II–7 describes the data analysis and report writing procedures.

In order to provide a manageable, compact overview, this manual focuses on the most important information. For the purposes of illustration, a household questionnaire has been included in Annex 6 as an example. The remaining questionnaires, together with detailed descriptions of specific activities and supporting documents, can be found in a supplementary Digital Annex.[24]

Each chapter starts with an information box that summarises the objectives, time requirement, activities and the main products of the task set described. The products specified in each information box can be used as a checklist to be completed for each activity and task set. The activities are then described and explained in detail below the box.

All recommendations are based on experience gained during field work conducted by the SLE study team in West Nile between August and October 2011. Because the actual M&E process is not expected to start until mid-2013 at the earliest, it has not yet been possible to define the M&E framework, especially the sampling, in full. This must be updated by the M&E consultant in order to conduct the baseline survey (see II–3.1). Further modifications may be required in certain procedures, due to changes which might take place in the region; but if any procedural amendments prove necessary, it is important to use the same set of indicators and questionnaires in the baseline survey and in each of the M&E cycles, in order to safeguard the comparability of the results.

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24 The Digital Annex as a compressed data archive and the report as digital document are available from the SLE website (http://www.sle-berlin.de/index.php/de/studium/publikationen/studien).

1.2 Outline of M&E cycles

Starting with a baseline survey in 2013, monitoring will be implemented over three consecutive cycles, in 2015, 2017, and 2019. KfW will assign a consultant, who will be responsible for the implementation of the baseline survey and the respective M&E cycles. The following paragraphs summarise the principle implementation steps and their products, set out a timeframe, and specify the personnel and budget needed.

Implementation steps and products

A M&E cycle comprises three phases (see Figure 7). In the preparation phase (see II–2 and II–3), the consultant has to establish contacts with all the stakeholders involved, appoint the required staff (five coordinators), and make all necessary logistical arrangements. For the baseline survey, the preparation phase also includes verifying the proposed samples for trading centres, secondary schools and health centres.

The data survey and the field survey are both conducted in the implementation phase (see II–4 and II–5). For the data survey, information is collected from KfW, GIZ, and WENRECo as well as from ministries and other national institutions, while the field survey gathers primary data through interviewing households, businesses, secondary schools, and health centres.

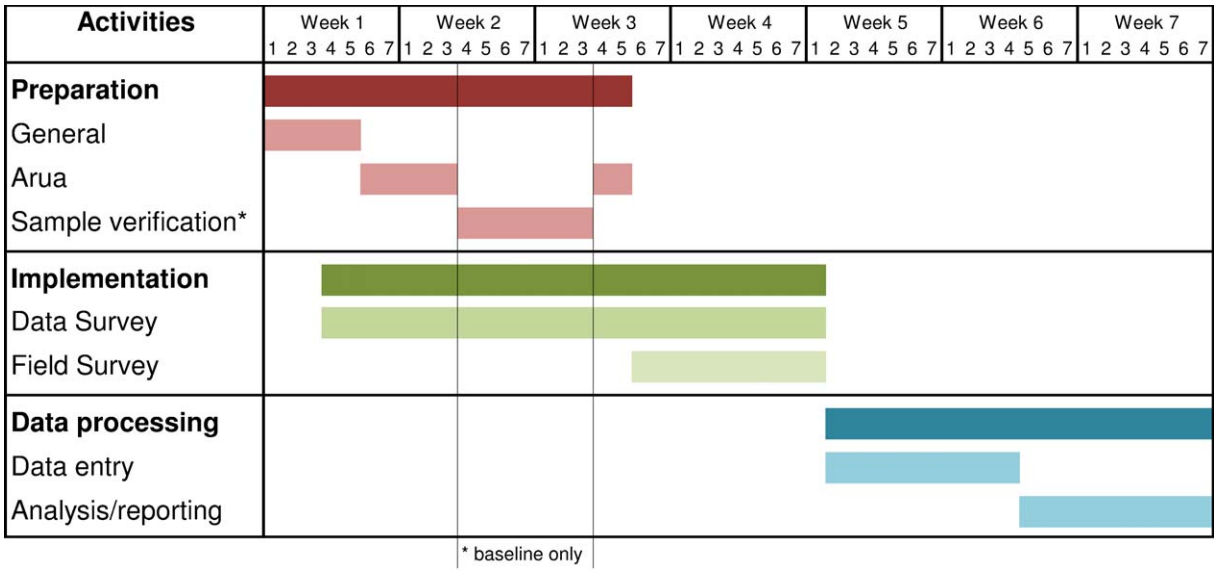
The data processing and reporting phase (see II–6 and II–7) covers the entry of all field data into the prepared spreadsheet files, control of the data entered, analysis of that data, and preparation of the report.

The M&E consultant has to produce a baseline or monitoring report as presented in Part III. This will be based on a total of (1) some 1,990 interviews (conducted with 900 households, 825 businesses, up to 170 secondary schools and up to 95 health centres), and (2) an extensive data survey.

Timeframe

Based on experience gained during the development and testing of the M&E system and during the pre-baseline investigation, the following timeframe is proposed: a standard M&E cycle can be implemented in 42 working days, whereas the baseline survey will require seven additional days for sample verification. Figure 7 gives an outline of the time planning for each phase and task set in the M&E survey.

Figure 7: Timeframe and implementation steps of M&E activities



Personnel

To implement the M&E cycle, the consultant has to recruit a support team comprising:

- five coordinators for the preparation phase in Arua, the field survey and the data entry (for about 25 days for the baseline survey, or 18 days for a M&E cycle);
- 50 enumerators for the field survey (for seven to eight days);
- ten data entry persons (for eight days).

Recruiting 65 staff requires substantial administrative effort and thorough preparations need to be made. The consultant will be reliant on support from KfW and GIZ in Uganda, especially with regard to identifying the five coordinators. Contract templates can be found in DA–1 to DA–3.

Budget

Based on the SLE team's experience in 2011, the costs for the entire M&E survey will be roughly EUR 16,000 for a M&E cycle, excluding remuneration and expenses for the M&E consultant. The baseline survey budget incorporates the additional costs linked to the verification of the sample of trading centres. These costs include:

- personnel (coordinators, enumerators, data entry persons, other support – up to EUR 7,000 for a M&E cycle and EUR 7,500 EUR for the baseline survey);
- transport (a car with driver for the consultant, five minibuses for the field survey, including petrol up to EUR 5,500 for a M&E cycle and EUR 6,000 for the baseline);
- materials and communication (up to EUR 1,000);
- venue rent (office, training, data entry – up to EUR 1,000);
- accommodation for survey team (up to EUR 1,000);
- other costs (e.g. radio broadcasts – up to EUR 500).

2 Survey Preparation and Activities

Objectives: introduce the M&E consultant and his assignment to important stakeholders, collect secondary data, prepare required materials and organise logistics	
Time: 5 days	
Activities	Products
Establish communication with stakeholders	□ 2 MEMD reference letters □ Introductory letter from KfW □ KfW monitoring reports □ GIZ monitoring reports □ WENRECo data sheet
Start collection of secondary data	□ Ministry of Health data □ Ministry of Education and Sports data □ Uganda National Examination Board data □ Uganda Bureau of Statistics data □ Uganda Revenue Authority data
Prepare materials and organise logistics	□ 26 binder with printed questionnaires □ Material kits for 5 coordinators and 50 enumerators □ List of possible offices in Arua □ Coordinator candidates invited for interview in Arua □ Hire of car and driver arranged

2.1 Establishing relations with stakeholders

The consultant has to get in contact with the main stakeholders of the investment programme – MEMD, WENRECo, KfW, and GIZ – both to introduce himself and his mission, and to understand their needs, expectations, and priorities. For communications with district administrations and ministries, it is very important to get a reference letter from MEMD. The letter should explicitly address all Chief Administrative Officers of the six districts in West Nile and indicate the period and region in which the survey is being conducted, as well as detailing its purpose and the name of the M&E consultant (see DA–4 and DA–5 for a sample letter). A similar reference letter should be prepared by MEMD for use when approaching other ministries and national institutions.

KfW should provide a short introductory letter with information on the West Nile investment programme and the status of programme implementation. GIZ should also provide reports on the status of its activities, while WENRECo should provide its data sheet, updated for the last half-year reporting interval. All these documents should be collected well in advance of the M&E consultant's arrival in Uganda. The consultant

then can clarify any outstanding questions during short meetings with the four stakeholders in Kampala.

2.2 Collecting secondary data

Once the consultant has received the reference letters from MEMD, s/he can start the collection of secondary data, by contacting the following institutions:

- Ministry of Health;
- Ministry of Education and Sports;
- Uganda National Examination Board;
- Uganda Bureau of Statistics;
- Uganda Revenue Authority.

The data survey process is described in II–4, and the required data is specified in Annex 2. As it takes some time to get this data, it is recommended that all these institutions are contacted well in advance and, if necessary, visited during the stopover in Kampala to obtain all the data before travelling into West Nile.

2.3 Preparing materials and organising logistics

Before arriving in Arua, certain logistical preparations need to be made. They can be divided into the following categories: materials, office space, personnel, and transport.

Materials

All materials required for the implementation of the M&E cycle should be organised in advance in Kampala. The main materials that need to be prepared are:

- coordinator kits (5 times);
- enumerator kits (50 times);
- training materials;
- 26 binder containing the printed questionnaires for households (1,420 copies), businesses (1,290 copies), secondary schools (320 copies), health centres (320 copies) and water suppliers (52 copies).

If possible, material preparations should be completed before the consultant arrives in Kampala. The required materials are specified in detail in DA–6.

Office space

An office in Arua must be located and rented, to provide working space for the consultant as well as space (at least for meetings with) up to five coordinators. A printer and scanner should also be arranged. While conducting pre-baseline investigations, reliable electricity supply proved to be an issue. Therefore, information regarding the current electricity situation and the availability of backup power for the office should be obtained beforehand.

Personnel

The consultant should be in a position to select the coordinators as soon as s/he arrives in Arua. Therefore, the vacancies should have been advertised beforehand, and applications preselected in advance. GIZ personnel in Arua might be able to help here, as they may have worked with good coordinators in the past. If that is not the case, then the vacancies should be advertised on the radio or on public notice boards at the district administration headquarters. A list of coordinators engaged in earlier studies (starting with the pre-baseline investigation in 2011) will be maintained by KfW.

Transport

The M&E consultant needs reliable and flexible transport, so that he can introduce himself in all six districts and supervise the field phase. It is therefore recommended that a vehicle and driver is hired for the whole assignment period.

3 Survey preparations and activities in Arua

Objectives: complete preparations for the field survey, by verifying the sample, preparing personnel and logistical requirements, and by introducing the consultant, the team, and the mission to local stakeholders	
Time: 7 days for a regular M&E cycle; plus 7 days for the baseline survey (verification of sampling)	
Activities	Products
Verification of the proposed sample	□ List of TCs, schools, and health centres updated □ The sample of TCs, schools, and health centres validated
Introductory meetings with local stakeholders	□ Reference letters from CAOs □ Enumerator vacancies
Selection and training of the coordinators	□ Coordinators selected and hired □ Coordinators received training
Organisation and logistics	□ 5 survey regions and teams defined □ Coordinators completed their survey preparations □ Venue for data entry rented (school in Arua) □ Vacancies for data entry advertised

3.1 Verification of the proposed sample

At the time the M&E framework was developed, planning the grid extension had not yet been finalised. Before the baseline survey can be implemented, it is therefore necessary to validate the proposed sample of trading centres and to identify the secondary schools and health centres that will be connected.

For regular M&E cycles, the lists of trading centres, schools, and health centres only need to be updated. Only if any trading centres, schools, or health centres within the control group have become connected to the grid or have been targeted by solar or hydro programmes, similar action needs to be taken as subsequently described for the baseline.

When carrying out the baseline survey in 2013 a more extensive verification procedure will be required. Seven days are scheduled for this. Four days are allocated for visiting the trading centres, and three days for cross-checking the data obtained during the field trips with data collected from WENRECo, the Ministry of Health and Ministry of Education and Sports. Verifying the sampling of trading centres and verifying the sampling of schools and health centres requires two different approaches to be adopted.

Verification of trading centres

The WENRECo data sheet lists those trading centres which have been electrified. During the meeting with WENRECo in Kampala, it should be confirmed that this list is up to date. Based on the list, it must be established whether any trading centres proposed for the sample are not going to be connected, and if any trading centres proposed for the comparison group are now planned to be connected to the grid. In both cases, those trading centres must be replaced. It might also happen that some of the selected trading centres are targeted by other energy projects (e.g. with pico hydro power or solar home systems). In such cases the M&E consultant should carefully consider whether the respective trading centres need to be replaced by others.

Furthermore, it is necessary to verify whether the treatment and comparison trading centres are still comparable. In order to do so, each of the 20 selected trading centres (see Table 9) has to be visited and surveyed. The following aspects need to be assessed and the sampling data sheet updated accordingly (see DA–7):

- estimate of population living in the trading centre;
- estimate of households in the trading centre;
- estimate of permanent businesses in the trading centre;
- market type: no market, street market, market with official market days;
- estimate of vendors in the market.

As the trading centres in themselves are not administrative bodies, it is not easy to obtain the data required for the verification process. If available, the best option is to visit the head of the trading centre committee, its secretary, or one of its members. Otherwise the local administration (e.g. sub-county chief) can help to get the data listed above. It might also be sensible to interview several respondents in the trading centre to get an acceptable estimate. Moreover, it is usually necessary to use probing questions to verify if the data given is more or less correct. If the updated data shows that the trading centres in both groups are no longer comparable, new trading centres have to be selected according to the criteria described in I–5.2.

Table 9: Sample areas to be visited

Districts	Treatment Group	Comparison Group	Towns
Koboko, Yumbe	Logonda, Kuluba	Lobe, Lomunga	Koboko, Yumbe
Arua, Maracha	Okokoro (Kijomoro), Adraka	Kubala, Udupi, Biliefe, Omugo	Maracha
Nebbi, Zombo	Angal, Kasatu (Angaba), Dei, Nyaravur, Logiri, Atyak	Rhino Camp, Kucwiny, Erusi, Mutir	Pakwach, Zeu, Zombo

Defining the sample for secondary schools and health centres

Within its data sheet, WENRECo provides a list of all schools and health centres that are already connected and are planned to be connected once the grid extension is finalised. This data should be confirmed in a meeting with WENRECo. This list needs to be cross-checked against the list of all secondary schools and all health centres in the six districts (see DA–7 and DA–8), and this must be updated with the new data provided by the Ministry of Education and Sports and Ministry of Health.

All secondary schools and all health centres of levels (III–V) that get connected will be surveyed. From the remaining unconnected secondary schools and health centres (III–V) an appropriate panel needs to be drawn to form the comparison group (see I–5.2).

3.2 Meetings with local stakeholders

Meetings with the Chief Administrative Officers of all six districts should be conducted to explain the purpose of the survey and to gain support (using the reference letter from MEMD). For the baseline survey, these meetings should be arranged in advance during the sample verification process. It is recommended to ask the CAOs for a reference letter, stating the names of the consultant and the five coordinators together with the aim and timeframe of the M&E activities, as such a reference letter is needed when dealing with local district, county, and parish administrations. The meeting should also be used to ask for experienced local enumerators, and to place an official advertisement regarding these positions on the public information board. If further questions regarding the WENRECo data arise, they can also be discussed with the WENRECo management based in Arua.

3.3 Selection and training of coordinators

At the pre-arranged meeting with the coordinator candidates, five coordinators need to be selected in accordance with the specifications described in the contract template (see DA–1). The coordinators have three main responsibilities: to make the necessary preparations for the fieldwork, to organise and direct the fieldwork, and to check the collected data. The coordinators also have to contact the local authorities prior to the survey. The responsibilities and mandates of the coordinators are also defined in the contract template. The coordinator training programme covers in-depth understanding of the questionnaires, sampling procedures, and the process for selecting competent enumerators. Training for the coordinators is described in detail in DA–10.

3.4 Organisation and logistics

Together with the coordinators, the M&E consultant has to plan and make the necessary preparations for the field trip and for data entry.

Preparation for the field survey

The 26 trading centres and towns included in the survey, as well as up to 170 secondary schools and up to 95 health centres, need to be divided into five regional clusters and assigned to the five survey teams. Each survey team consists of one coordinator and ten enumerators. To ensure the field surveys run smoothly, we recommend hiring a minibus for each of the five survey teams for the full duration of the field phase.

Each coordinator will receive the following materials:

- a coordinator kit;
- a material kit for the training of enumerators;
- ten enumerator kits;
- five to seven binder, containing the questionnaires.

The contracts for the enumerators (see DA–2) should be prepared and signed by the M&E consultant in Arua and handed to the coordinators. The coordinators have to explain the terms of the contracts to the enumerators and fulfil the recruitment procedures.

During the meetings with the CAOs, the district authorities will already have been informed about the M&E activities. However, the coordinators still need to contact all the local authorities in the six towns and 20 trading centres prior to the field survey. The local population should be made aware of the survey through notices placed on public information boards. A radio feature announcing the survey's purpose and the timeframe for the planned field visits could be broadcast. This would inform the public and promote understanding among potential respondents at the same time. The vacancies for enumerators and data entry staff should also be announced during this preparation phase (see II–2.3) by specifying the job requirements, the timeframe, and the salary on offer.

Preparations for the data entry phase

After the field survey, all data collected needs to be entered into spreadsheet data files. Because of the large number of interviews, a total of ten data entry persons are required for a total time of seven days (one day training, five days data entry, and one day for validation).

To provide the number of computers required for the data entry exercise, we recommend renting a computer classroom in a local school in Arua. The school must have a reliable power supply (available over extended working hours), plus at least ten computers, each with suitable spreadsheet software already installed (e.g. MS Excel or LibreOffice Calculator).

The vacancies for data entry staff should be published and communicated in a timely fashion. If any enumerators from Arua have been recruited, it might be useful to recruit the same persons for the data entry task. For the selection and training of data entry personnel, see II–6.1.

4 Data Survey

Objective: collect all M&E data elements that are not obtained through the field survey	
Time: ongoing process, which should be conducted in parallel with other activities	
Activities	Products
Obtaining secondary data	□ Completed WENRECo data sheet □ Completed sampling data sheet □ Completed higher-level impact data sheet □ Updated population data for districts of West Nile

I–5.3 provides an overview on the secondary data required for the M&E framework and a summary of the sources from which this data can be obtained. The collection of secondary data starts right at the beginning of the M&E assignment, as described in II–2. In addition to KfW, GIZ, and WENRECo, the following five institutions also need to be contacted:

- Ministry of Health
- Ministry of Education and Sports
- Uganda National Examination Board
- Uganda Bureau of Statistics
- Uganda Revenue Authority

The consultant has to make an official request for the information, specifying the purpose and the data required, and attaching the reference letter from MEMD. A list with contacts to these institutions is deposited with KfW, while the required data is specified in Annex 2.

The secondary data is collected for four different purposes:

1. The lists of schools and health centres collected from the Ministry of Health and Ministry of Education and Sports, together with the list of trading centres, schools, and health centres obtained from WENRECo, are needed for sampling purposes.
2. All the data from KfW, GIZ and WENRECo is required to monitor the Output and Use of Output indicators.
3. The data from UNEB (mean school grades for each school) and URA (number of registered businesses in West Nile) is collected to provide additional pointers for the evaluation phase, regarding potential high-level aggregated Impacts on economic activities, and educational performance.
4. The data from UBoS is needed to cross-check population data and the mean household size in West Nile (especially once the results from the 2012 Census

are available). Furthermore, UBoS provides the consumer price index for Uganda and for Arua town, and several more socio-economic indicators at district or sub-region level (see Annex 2) which can be used as reference during evaluation.

The data is collected in three spreadsheet files: the sampling data sheet (DA–7), the WENRECo data sheet (DA–8), and the higher-level data sheet (DA–9).

5 Field Survey

Objective: collect representative data on households, businesses, secondary schools, and health centres for both the treatment and comparison group	
Time: 12 days	
Activities	Products
Preparation visits	□ Introductory meetings with local authorities conducted □ Micro-sampling areas identified and mapped
Selection and training of enumerators	□ Enumerators recruited □ Enumerators received training
Obtaining data within field trip	□ 900 household interviews □ 825 business interviews □ Up to 170 school interviews □ Up to 95 health centre interviews
Administration and documentation	□ Financial reports submitted □ Debriefing reports and documentation submitted

The field survey has to be planned in detail, and thorough preparations must be made by the coordinators. To facilitate this task, DA–11 provides an activity planning template.

5.1 Preparation visits

Prior to the field survey, the coordinator must carry out preparation visits to the town areas and trading centres. The purpose here is to announce the field visit to the local authorities and population, and to identify the micro sampling area in accordance with the sampling guides (DA–12 and DA–13). The sample area for each enumerator must be identified and, where feasible, marked by distinct landmarks (roads, rivers, houses, trees, buildings). If possible, the coordinator should provide a simple, hand-drawn map of the survey area indicating distinct landmarks. Local authorities must be informed of the preparation visit at least a day in advance.

5.2 Selection and training of enumerators

For each survey team, ten enumerators have to be identified, hired, and trained by the coordinator. The coordinator must have met, interviewed, and selected the enumerators before engaging them. The minimum qualifications for enumerators are the completion of Senior 6-level school grade, the ability to speak both fluent English and

the local language of the survey area, and experience of surveys and interview techniques. DA–2 provides a contract template.

It is highly recommended that the team of enumerators is gender-balanced. All the enumerators' telephone numbers must be recorded to facilitate the interview process in the trading centres and towns. The identification of potential enumerators can best be done by contacting either the planning officers or community development officers in the district administration headquarters (for example, after meeting the CAOs as outlined in II–3.4), as they are used to working with teams of enumerators. Alternatively, the vacancies can be advertised on the radio or on the town notice board.

The quality of the survey is heavily dependent on the quality of interviewing. Therefore the coordinator must give the enumerators two days of training to ensure an in-depth understanding of the sampling procedures and the contents and structures of the questionnaires. The training programme includes a brief introduction to the survey's aims, a step-by-step guideline to the questionnaires and sampling procedures, and practical exercises to provide valuable experience before conducting the interviews or sampling procedures. For details of the training programme, please refer to the training schedule in DA–14. The coordinator has to arrange a suitable venue for delivery of the training in the survey area, and must inspect the venue before the training is carried out.

5.3 Gathering data in the field survey

All primary data within the field survey is obtained by the enumerators and coordinators. The major part of survey data is collected in interviews with households, businesses and institutions (schools and health centres). The coordinator is in charge of gathering additional data on water supply in the selected sampling settlements.

When planning the field survey, it is important to take into account seasonal factors, such as school holidays and harvest seasons. It is difficult to find the best days for obtaining data from different units of analysis. For example, weekends are best for conducting household interviews, but are unlikely to be suitable for interviews in health centres and schools. Market days are best for reaching the maximum number of businesses, but not for interviewing adult respondents at home.

On average, each survey team has to cover four trading centres and one to two towns. In each trading centre 30 households and 28 businesses need to be interviewed, requiring nine enumerator days in all. In the towns, 50 households and 46 businesses are to be interviewed, which requires about 14 enumerator days. In addition every coordinator has to arrange about 53 interviews with schools and health centres, which requires another twelve enumerator days. In total between 35 and 51 enumerator days are required, which is feasible given a team of ten enumerators and

a field phase of six to seven days. Together with two days for the preparation visit and three days for contracting and training, a total of twelve days can be assumed for the field phase.

Questionnaires

The questionnaire is the main instrument for collecting comprehensive information about the units of analysis at different result levels (see Annex 6; DA–15 to DA–19). The questionnaire for households, businesses, schools and health centres consists of four to five sections. The questions in sections 2, 3, and 4 capture information relating to indicators at Impact level. The sections “Energy and fuel sources” and “Appliances” cover indicators at Outcome level, by gathering information on current usage of energy sources and access to energy services. It is critical to understand which fuels and energy sources are being used by the units of analysis in both electrified and comparison areas. This will help in understanding the results of the improved electricity-based services. The section “Safety and efficiency” captures information about the awareness of the units of analysis with regard to the safe use of electricity and the efficient use of energy. The questions in the “Safety and efficiency” section apply to households and businesses, as potential beneficiaries of GIZ awareness measures. The use of the questionnaires is also described in an explanation sheet in DA–20. For each town and trading centre, a binder containing an adequate quantity of household and business questionnaires and a water supplier questionnaire is provided (see also II–2 and II–3). An additional binder contains questionnaires for schools and health centres.

Supervision

While the survey is being carried out, the coordinator must observe and supervise the enumerators on the spot. During the lunch break, the coordinator should meet with all the enumerators and count the number of interviews already conducted (see DA–21). Meanwhile, the coordinator has to check completed interview forms for inconsistencies, empty fields, and any unclear data. Wherever possible, the coordinator should discuss any problems found and encourage correct form completion. The same tasks have to be done by the end of each survey trip.

If enumerators face difficulties (e.g. too few interviews completed), the coordinator has to accompany the enumerator in order to identify the causes.

5.4 Administration and documentation

Each coordinator in the survey teams must be equipped with sufficient cash, for which he or she is fully responsible. The budget is planned for each coordinator by the M&E consultant. The budget is planned to cover (1) the wages and allowances of the enumerators, (2) hiring of training venues, and (3) communication costs and miscellaneous expenses. A draft financial plan and budget receipt (as was used during the pre-baseline investigation) is presented in DA–22 and DA–23. The coordinator has to account for all expenditure against the various budgets. All expenses must be documented in the budget documentation table provided (see DA–24), and supporting receipts submitted. Both the financial plan and the budget documentation table will help the coordinator to monitor their expenditure.

By the end of the field survey, the coordinator is obliged to hand over to the M&E consultant all completed questionnaires, the survey materials, and the documentation from the field trip during a de-briefing session.

6 Data Entry Process

Objective: accurately enter the field data collected into the main database file	
Time: 8 days	
Activities	Products
Selection and training of data entry specialists	□ Team of 10 data entry persons recruited □ 1-day training for data entry persons completed
Data processing	□ Data entered into the data base file
Verification of data entered	□ Cross-check of entered data completed

6.1 Selection and training of data entry personnel

Selection procedure

The recruitment procedure for data entry staff is similar to that for coordinators and enumerators. As well as radio broadcasts, these vacancies could be posted with NGOs or other organisations working in Arua. The candidates for the data entry positions could also be recruited from those enumerators who live in Arua, as they are very familiar with the questionnaires and the data being collected. The qualifications needed for the data entry process are similar to those for enumerators, with the addition that computer skills are required. A sample contract for data entry personnel can be found in DA–3.

Training

Once recruited, data entry personnel need to be familiarised with the survey's subject matter, as well as with each questionnaire and the spreadsheet entry forms. This training is designed to take one day (see DA–25). Generally, each questionnaire needs to be discussed with the group and a typical example entered into the system.

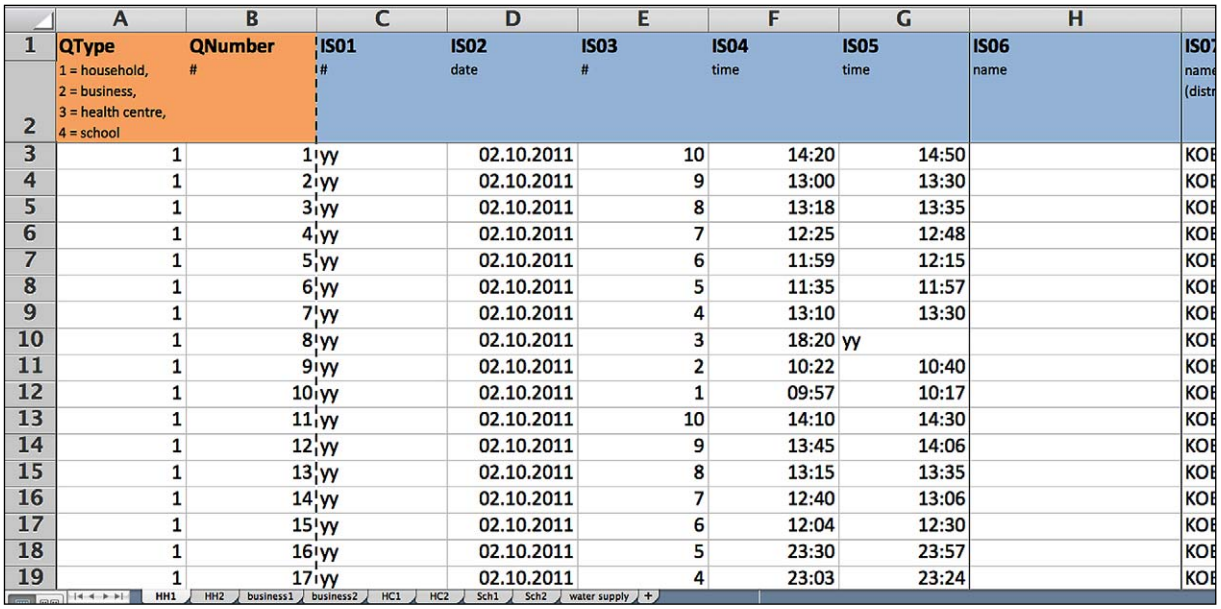
6.2 Data entry

Accurate and comprehensive data entry is essential for error-free analysis and sound survey results. Data from almost 2,000 questionnaires needs to be entered. One data entry specialist can enter around 40 questionnaires in a day (eight working hours). Ten data enter specialists will require five to six working days to enter all the data collected. It is recommended to employ two of the coordinators to oversee the data entry process as well, as this will ensure tighter supervision.

Data entry form

Simple spreadsheet software is used to process the collected data. A single database file has been developed in which all the information from the household, business, health centre, and school questionnaires as well as the data collected from local water suppliers should be entered (see Figure 8). The spreadsheet template (see DA–26) is explained in brief below.

Figure 8: The data entry form



	A	B	C	D	E	F	G	H	
1	QType	QNumber	IS01	IS02	IS03	IS04	IS05	IS06	IS07
2	1 = household, 2 = business, 3 = health centre, 4 = school	#	#	date	#	time	time	name	name (distr
3	1	1	yy	02.10.2011	10	14:20	14:50		KOE
4	1	2	yy	02.10.2011	9	13:00	13:30		KOE
5	1	3	yy	02.10.2011	8	13:18	13:35		KOE
6	1	4	yy	02.10.2011	7	12:25	12:48		KOE
7	1	5	yy	02.10.2011	6	11:59	12:15		KOE
8	1	6	yy	02.10.2011	5	11:35	11:57		KOE
9	1	7	yy	02.10.2011	4	13:10	13:30		KOE
10	1	8	yy	02.10.2011	3	18:20	yy		KOE
11	1	9	yy	02.10.2011	2	10:22	10:40		KOE
12	1	10	yy	02.10.2011	1	09:57	10:17		KOE
13	1	11	yy	02.10.2011	10	14:10	14:30		KOE
14	1	12	yy	02.10.2011	9	13:45	14:06		KOE
15	1	13	yy	02.10.2011	8	13:15	13:35		KOE
16	1	14	yy	02.10.2011	7	12:40	13:06		KOE
17	1	15	yy	02.10.2011	6	12:04	12:30		KOE
18	1	16	yy	02.10.2011	5	23:30	23:57		KOE
19	1	17	yy	02.10.2011	4	23:03	23:24		KOE

HH1 HH2 business1 business2 HC1 HC2 Sch1 Sch2 water supply +

For each unit of analysis, there are two sheets in the spreadsheet template in which data must be entered. The first sheet for each unit covers the first half of the questionnaire, including the section on energy sources and fuels, and the second sheet covers the rest of the questionnaire. The last sheet covers the data from the water suppliers.

Each column in the data entry form represents one variable or answer field of the questionnaire. Each column is identified with a code, consisting of two capital letters and a serial number, e.g. GI01. These correspond with the codes found in the top left of each box to be filled out on the questionnaires. The next cell down, in the second row of the form, shows the unit of measurement for that particular variable.

A separate row in the data entry sheet is used for each unit that was interviewed. Hence, the information of one questionnaire corresponds with one row of the data entry form. The filled data entry form is finally called “field database” and used for data processing and indicator calculation later on.

The first column (A, called “QType”) in each sheet indicates the unit of analysis. The relevant code number (from 1 to 4) has already been entered. The questionnaire serial number is entered in the following column (B, called “QNumber”). This is a consecutive number allocated by the data entry supervisor. The following columns corre-

spond with the respective questions of the questionnaires. Colours and lines are used to separate different sections in the spreadsheet and to help data entry.

Generally, each column has already been formatted according to the type of question and the unit for each question or variable. These include: text format for names (e.g. the name of the district); integer number format for numbers (e.g. the number of household members); number format with decimal places for amounts in UGX (e.g. expenditure); and 24 hour format for times (e.g. business hours). For other variables with a 'yes/no' answer, codes are provided, with '0' for no and '1' for yes, or '1' for male and '2' for female. Variables reflecting open questions are formatted as text.

It is important that the data entry staff follows the rules below:

- cell formats must not be changed;
- options within the spreadsheet template must not be changed;
- each data entry person has to save a copy of the data entry form (with his or her initials and the date) each day on the computer at which s/he is working;
- the file must be saved regularly;
- there should ideally be no empty boxes on completed questionnaires. Hence, during data collection, enumerators were instructed to cross out questions that did not apply, and enter "999" if the respondent was either unable or unwilling to provide an answer. During data entry, these records need to be transferred. For "999" and boxes left blank in the questionnaire, "yy" should be entered. For crossed-out questions, or questions which were not applicable, "xx" should be entered;
- any questions or irregularities must be addressed to the supervisor and/or written on a comment sheet.

Supervising the data entry

Immediately before processing the data, each questionnaire has to be given a unique serial number. For each unit of analysis it starts from one. Typically this number should be allocated by the consultant receiving the completed questionnaires for data entry. The number is written in the box marked "QNumber" on the first page of each interview guide.

Data entry supervision includes making sure that all the data is entered correctly. An appropriate number of cross-checks should therefore be carried out for each data entry person. It may be impossible to guarantee that no mistakes are made by the enumerators during data collection. Hence the supervisor needs to be on hand to answer questions and document irregularities, or to set rules on how particular cases should be treated. Furthermore, the files need to be collected at the end of each day and stored for backup by the supervisor.

Verification of data entered

The data entered must be checked for inconsistencies, such as unreasonable or impossible quantities. The first procedure is to cross-check the data entry sheets with the information given in the questionnaires. If the data in the questionnaire itself is unrealistic (e.g. households with 50 members, or exorbitant fuel consumption) and the reasons cannot be identified, then the erroneous data must be deleted. Any data entry errors identified that were made by the data entry team must be corrected. The plausibility of one piece of data can be verified by cross-checking with other relevant data; for example, by comparing the number of energy sources used in the month with expenditure on these energy sources, or by comparing the total number of family members with the number of females and males belonging to families.

7 Data Analysis and Report Writing

Objective: analyse the data collected and present the results in a report	
Time: 10 days	
Activities	Products
Analysis and calculation	□ Indicator calculation sheets updated
Report writing	□ Report completed and submitted

7.1 Data analysis and calculation

During each monitoring cycle, a large amount of data is collected on predefined data elements so that indicator values can be calculated. The data from the field survey (some 2,000 standardised interviews in total) needs to be entered into one main data spreadsheet. Additionally, the data survey collates and contributes data from WEN-RECo, KfW, GIZ and other sources.

Data to be processed comes from a variety of sources and in a variety of formats:

- KfW and GIZ reports;
- the WENRECo data sheet;
- the sampling sheet;
- the higher-level impact sheet;
- the field database file;
- additional UBoS data.

For the data processing spreadsheet, files have been prepared for all the indicators, and data from the pre-baseline survey has been entered and indicators calculated in these files, to provide an example. The data from the baseline survey and from each consecutive monitoring cycle must be entered into the corresponding indicator files and the “summary sheets” filled to create the reporting results. Each spreadsheet file has been named with reference to the relevant indicator, e.g. “Indicator_OC1.1.” (see DA–27). Calculations are performed by spreadsheet formulas and functions. Results are presented in diagrammatic form (between one and ten diagrams per indicator).

In case indicator data is analysed for households and businesses surveyed in trading centres, the attribution of each interviewed unit to either treatment group (electrified TC), comparison group (not electrified TC), or town needs to be done manually as a first step. If baseline data is collected prior electrification it is important to note, that units surveyed as treatment group are actually units to be categorized as electrified. Moreover, depending on the indicator additional calculations might be required and variables need to be created. However, the example data can be used as guidance.

No spreadsheet files are prepared for Output indicators, as only the status of implementation is monitored (in terms of ‘not yet started’, ‘in progress’, and ‘completed’) for each half-yearly monitoring interval. The data from KfW, GIZ, and WENRECo is used for the Output indicators.

The Use of Output indicators on the supply side (WENRECo performance indicators) are also monitored on a half-yearly basis, and indicator spreadsheets are provided to produce diagrams on progress at WENRECo. For the Use of Output indicators the WENRECo data is used, with the exception of the average number of households and businesses sharing a connection, which is obtained from the field database file.

For each of the other indicators, a spreadsheet is prepared to calculate the indicator value and produce the diagrams. The field database file (cross-checked with some UBoS data elements) is used as the main database here.

Alongside the general processing and analysis procedure, surplus data is actually gathered during each monitoring cycle, both in the field data base file and the higher-level impact file. This is not needed for detailed analysis during each monitoring cycle, but is available for a more disaggregated analysis if required (see I–6.3). If necessary, much more detailed calculations are generally possible to track further changes in areas of interest. Furthermore, the data collection format and the design of the questionnaires would even allow for comparisons at an individual level, and for the application of more sophisticated statistical tools.

7.2 Report writing

A report format has been developed, which is presented in Part III. Indicator values – for the baseline survey, as well as for each monitoring cycle – can be displayed immediately within the indicator diagrams. These are presented alongside an indicator sheet, which provides an overview for each Outcome and Impact indicator. This outlines the rationale behind (and interpretation of) the indicator, and details the data elements required together with the code for the variable, which in turn refer back to the database file.

The diagrams show the results of the pre-baseline investigation, the baseline survey, and of each monitoring cycle, to enable results to be compared over time.

With regard to the indicators at Outcome and Impact level and those which relate to households and businesses in general, three averages are calculated. These refer to (1) the average situation in non-electrified trading centres, (2) the average situation in electrified trading centres, and (3) the average in towns. In the case of schools and health centres, a comparison is only made between non-electrified and electrified establishments, and their respective mean values are calculated. The difference be-

tween the treatment and the comparison group can then be attributed to the programme interventions.

The presentation of the results in the report follows the logic of the results chain; the description of results starts with the Outputs, and ends with the results at the Impact level. The data from the baseline survey and from every monitoring cycle will be used for the next monitoring cycle (or evaluation) to track the changes generated by programme interventions. The data presentation format is designed to support the discussion of results.

Part III

M&E Results Reporting

Contents

1 Introduction

Parts I and II set out the theoretical and methodological foundations for the M&E framework and provided guidance for its practical implementation. Part III proposes a reporting format for the presentation and analysis of M&E results. For the purposes of illustration, this proposal has been presented using the data collected in the pre-baseline survey.[25]

The report format consists of two chapters, covering the presentation of the indicator values and the analysis and discussion of the results.

Chapter III–2 follows the sequence of the result chain, presenting Output, Use of Output, Outcome, and Impact indicators in separate sections. Each section starts by introducing the indicator properties, then the M&E results are presented in the form of tables or diagrams. Since the complexity of the indicators and their implications for M&E reporting increases with the respective results level, the reporting structure varies accordingly.

At the Output level, indicators are not discussed in detail, and information is provided only on data sources and data collection. Reporting is accordingly confined to the essentials and summarised in a table which shows progress on Output delivery.

At the level of Use of Output, the indicators are clustered into two groups: supply side (UP1) and user side (UP2). These indicator sheets also include definitions, and detail the data elements required along with their variable codes, which refer back to the database. These results are presented in diagrams.

The indicators at the Outcome and Impact levels are presented in even greater detail, with one indicator sheet for each indicator. The rationale on how this indicator feeds into the framework and seeks to make the result measurable is described and its limitations are discussed. Information is then provided on data sources and data collection, data elements, and codes for variables.

Chapter III–3 then analyses and discusses the results presented and offers recommendations. To this end, the discussion focuses first on the quality of the collected data and then on the issue of how far the results measured can be attributed to the programme intervention. Finally, the results for all levels are discussed, and recommendations made for further activities.

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25 The pre-baseline survey was carried out on October 2 and 3, 2011 in the three towns of Koboko, Zombo, and Pakwach, and the three trading centres of Oraba, Warr, and Panymur. During this survey 284 households, 169 businesses, 16 health centres, and 16 schools were interviewed. The survey was mainly performed in order to test the practicability and feasibility of the framework that had been developed, as well as to identify likely bottlenecks and elements where changes are needed. Therefore, it differs from the planned baseline in that no comparison group has been surveyed.

2 Indicator Sheets

This chapter presents the status of the indicators for each results level. Before presenting the indicators themselves, some general explanations on indicator terminology and indicator calculation are provided below.

The phrase “business-as-usual” in the formulation of the indicators has three interpretations. Firstly, in the case of information collected from households and businesses in trading centres, business-as-usual refers to the information collected from households and businesses in the comparable trading centres; secondly, in the case of information collected from households and businesses in town areas, business-as-usual refers to the initial baseline data that was collected from households and businesses in the town areas; and thirdly, in the case of information collected from health centres and schools, business-as-usual refers to the information collected in the respective comparison health centres and schools.

The phrase “electrified area” in the formulation of the indicators refers to the aggregated values from the data collected in the electrified corridor. The individually collected data is processed into averages per type of unit of analysis (e.g. household, business) and thus results can be interpreted on an “area level”. By contrast with interpretations at an individual level, this approach was adopted to keep the M&E framework manageable in terms of data processing, analysis, and software requirements.

Indicator status is calculated using field survey data and complementary data provided by programme partners and third parties. All data is stored electronically in spreadsheet files (using the .xlsx format). Furthermore, each piece of information or variable carries its own code and name. The codes for each variable are detailed in the indicator sheets, so that the data used in each indicator calculation can be traced back to its source.

Finally, some abbreviations are used on the indicator sheets. They refer firstly to the results level for which the indicators were developed and secondly to the variable codes:

Indicator codes:

I	Impact level
OC	Outcome level
OP	Output level
R	Risk
UP	Use of Output level

Variable codes:

HH	Household
B	Business
HC	Health centre
S	Secondary school
WE	WENRECo
WS	Water supplier

2.1 Indicator sheet – Output level

The Output level results are the foundation of the M&E system. They focus on the supply side, encompassing WENRECo's electricity generation initiatives and the supporting measures implemented by GIZ. The information required in order to report at the Output level is provided by KfW (for OP1, OP2, OP5), WENRECo (for OP3.1, OP4.1), and GIZ (for OP3.2, OP4.2, OP6 to OP8).

As the GIZ activities (and hence the Outputs) are not yet finalised in detail, it is only possible here to offer suggestions on indicators and relevant data elements. Hence, the data presentation structure proposed is basic. Furthermore, GIZ will implement its own M&E framework for its activities; as soon as these are known, the indicators and the reporting structure must be modified accordingly, and corresponding changes made in the calculation file, 'output.xlsx'.

With regard to presenting the delivery status for different Outputs, in general only the date of final delivery can be shown. Where applicable, e.g. the GIZ outputs, the start and end dates could both be presented to report on progress.

Indicator sheet OP1 to OP8

Result	Indicator
(OP1) Renewable electricity generation capacities have been created	(OP1.1) SHP Nyagak I is operational and has been transferred to WENRECo
	(OP1.2) SHP Nyagak III is operational and has been transferred to WENRECo
(OP2) Grid extension lines have been constructed, and the existing grid rehabilitated	(OP2.1) 300 km of new 33 kV grid, including low voltage distribution lines, has been constructed and transferred to WENRECo
	(OP2.2) The existing grid has been rehabilitated
(OP3) A prepaid metering scheme has been introduced	(OP3.1) WENRECo has introduced a prepaid metering tariff
	(OP3.2) GIZ has supported WENRECo in organising a campaign to educate consumers on the advantages of a prepaid metering system
(OP4) Poor customers have been targeted with low cost connections	(OP4.1) WENRECo has introduced a low-cost connection scheme
	(OP4.2) GIZ has supported WENRECo in the development of an implementation and promotion strategy
(OP5) Increased capacity at WENRECo	(OP5.1) KfW has appointed a long-term consultant as General Manager of WENRECo to increase management capacity
(OP6) Increased capacity among local technicians	(OP6.1) At least three technicians from each major trading centre in the grid extension areas have been trained in safe house wiring practice

Result	Indicator
(OP7) The productive use of electricity has been promoted	(OP7.1) GIZ has supported WENRECo in designing and implementing an awareness campaign on the productive use of electricity
	(OP7.2) GIZ has supported WENRECo in organising business training and coaching for businesses on the productive use of electricity
(OP8) The safe and efficient use of electricity has been promoted	(OP8.1) GIZ has supported WENRECo in designing and implementing an awareness campaign on safety issues
	(OP8.2) GIZ has supported WENRECo in designing and implementing an awareness campaign on energy efficiency

Status summary for indicators OP1 to OP8

Table 10, OP1–OP8: Reporting on the status of indicators on Output level

	Half-year reporting										
Indicator	1/11	2/11	1/12	2/12	1/13	2/13	1/14	2/14	1/15	2/15	1/16
(OP1.1)	*										
(OP1.2)	-										
(OP2.1)	-										
(OP2.2)	-										
(OP3.1)	-										
(OP3.2)	-										
(OP4.1)	-										
(OP4.2)	-										
(OP5.1)	*										
(OP6.1)	-										
(OP7.1)	-										
(OP7.2)	-										
(OP8.1)	-										
(OP8.2)	-										

Key: - not started, * in progress, √ activity completed

2.2 Indicator sheets – Use of Output level

This chapter provides an overview on the status of the indicators on Use of Output level. Some general definitions are required regarding result UP1, the efficient, reliable, and broad-based supply of renewably produced electricity.

broad-based	refers to electricity supply in rural as well as in town areas and for small-scale as well as for large-scale consumers
rural areas	refer to areas in West Nile except towns (defined by being a district capital with a town council or having more than 20,000 inhabitants)
poor households	refer to households that have only a very limited connection with a capacity below 2.5 ampere or that receive a subsidised low-cost connection
technical losses	refer to the consumption of auxiliaries of the power generation and losses in transformers and distribution lines
commercial losses	are distinct from the collection rate, losses due to electricity theft and billing failures
collection rate	is the difference between billed and paid electricity consumption
black out	is a power cut for all or a group of customers caused by equipment failure
load shedding	is the planned and rotating disconnection of grid sections to manage power supply bottlenecks in the grid
average response time for consumer complaints	is the average time between a problem has been reported to WENRECo to the point the problem has been completely solved

Regarding UP2 – increased demand for electricity and awareness of productive energy use, energy efficiency, and of energy safety issues – some further definitions are required. Firstly, productive energy use refers to the use of energy “that involves the application of energy […] to create goods and/or services either directly or indirectly for the production of income or value” (White 2002: 33).

The information needed to monitor the indicators on Use of Output level one (UP1) is provided by WENRECo and the field survey. Calculations are performed in the indicator files ‘use_of_output UP1.xlsx’ and ‘use_of_output UP2.xlsx’.

Indicator sheet UP1

Result UP1: Efficient, reliable, and broad-based supply of renewably produced electricity		
Indicators	Data elements	Code
(UP1.1) a) The number of households, businesses, health centres, and schools with a physical connection to the island grid and b) the proportion of connections in rural areas and c) the proportion of connections for poor households has increased	(1) Number of connections for households, businesses, schools (Primary, Secondary, Vocational) and health centres (II, III, IV, V)	WE05, WE09, WE10, WE11
	(2) Average number of neighbours additionally connected per connected household and business	HH: GI11 B: IE32
	(3) Number of connections in rural areas	WE13
	(4) Number of connections of poor households (consumers with subsidised low cost connections and/or < 2.5 A connections)	WE14
(UP1.2) WENRECo has reached break-even point	(1) WENRECo's total income per half year	WE31
	(2) WENRECo's total expenditure per half year	WE03
(UP1.3) WENRECo has reduced its technical and commercial losses and its collection rate	(1) Electricity generated per half year (in MWh)	WE40
	(2) Electricity consumption billed per half year (in UGX and MWh)	WE28 WE35
	(3) Payments received for electricity consumption per half year (in UGX)	WE29
(UP1.4) The proportion of electricity produced from renewable energy sources in the island grid has increased	(1) Total electricity generated per half year (in MWh)	WE40
	(2) Total electricity generated from renewable sources per half year (in MWh)	WE37
	(3) Electricity generated (in MWh) per half year by Nyagak I and Nyagak III	WE38, WE39
(UP1.5) The proportion of blackout hours and load shedding in the island grid has decreased	(1) Total accumulated duration of outages per half year	WE44
	(2) Total accumulated duration of load shedding per half year	WE46
(UP1.6) WENRECo's maximum response time for blackouts and customer complaints has decreased	(1) Average duration of each outage	WE45
	(2) Average response time for customer complaints	WE49
(UP1.7) The proportion of WENRECo customers on a prepaid tariff has increased	(1) Total number of prepaid meters in operation per half year	WE17
	(2) Total number of customers per half year	WE08

Data presentation for UP1

Chart 1, UP1.1: Household connections

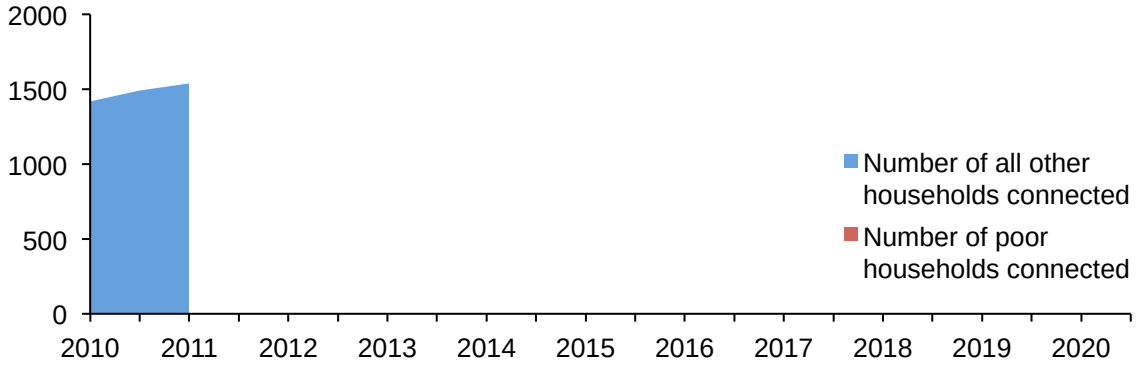


Chart 2, UP1.1: Connected businesses, schools, and health centres

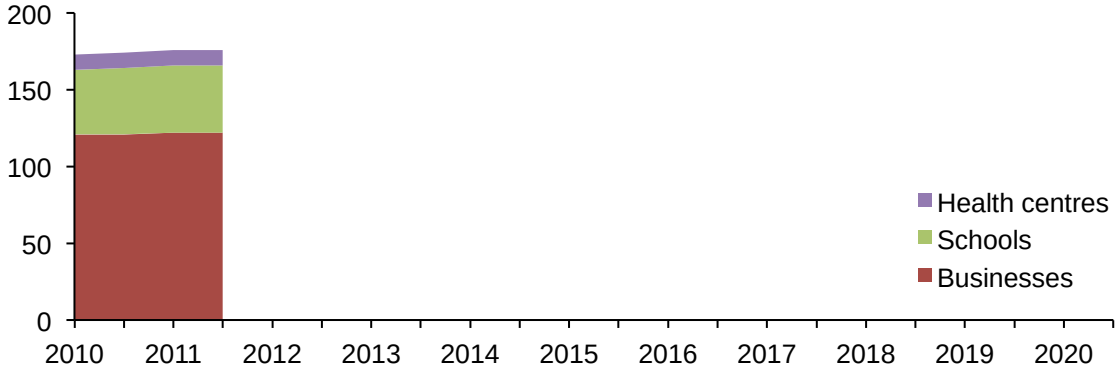


Chart 3, UP1.1: Connections in rural and urban areas

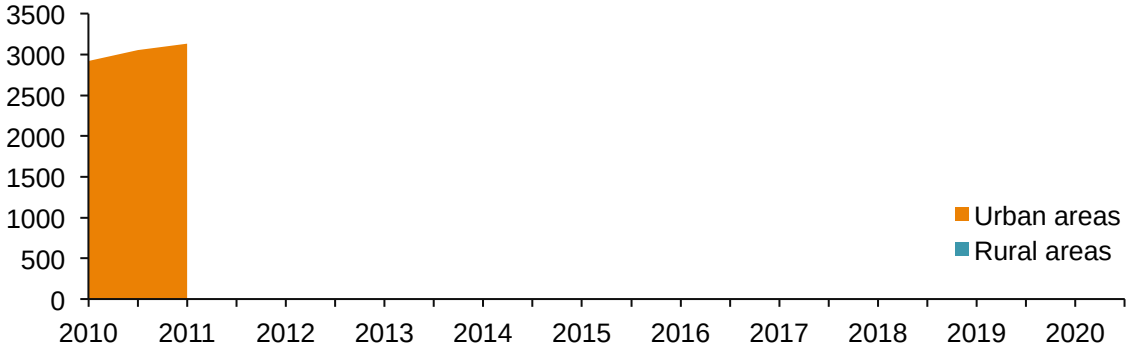


Chart 4, UP1.2: Gross profit margin of WENRECo

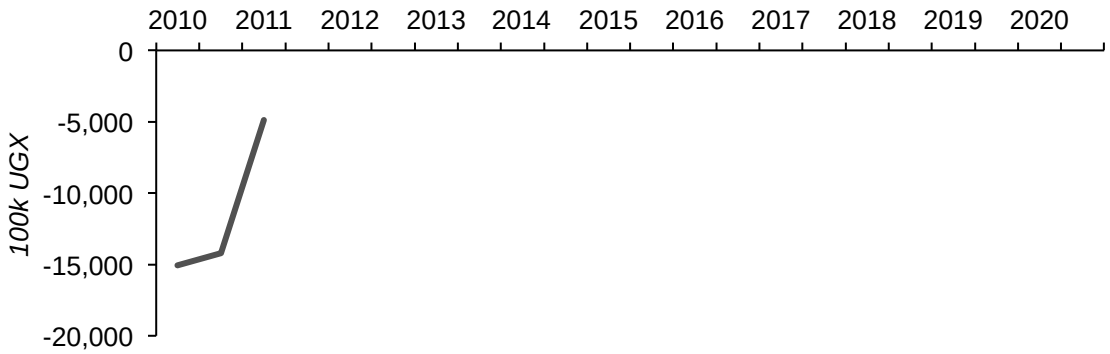


Chart 5, UP1.3: Technical and commercial losses (without collection rate)

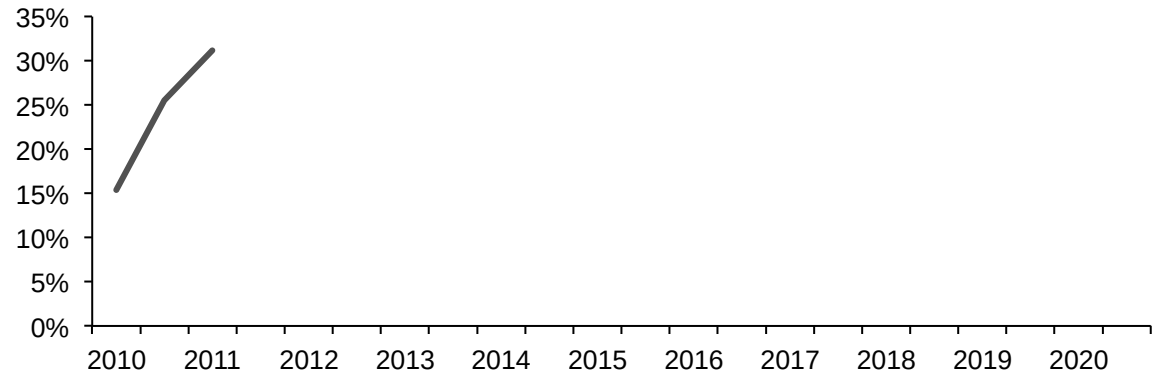


Chart 6, UP1.3: Collection rate

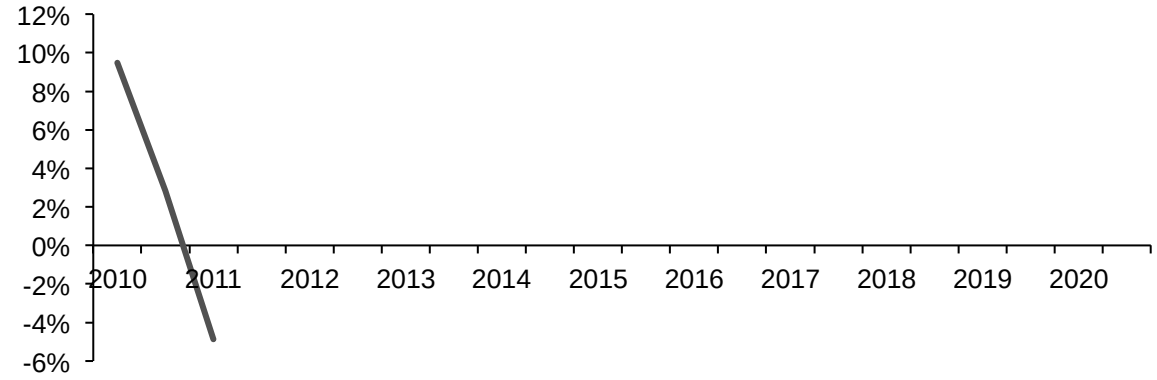


Chart 7, UP1.4: Proportion of electricity produced from renewables

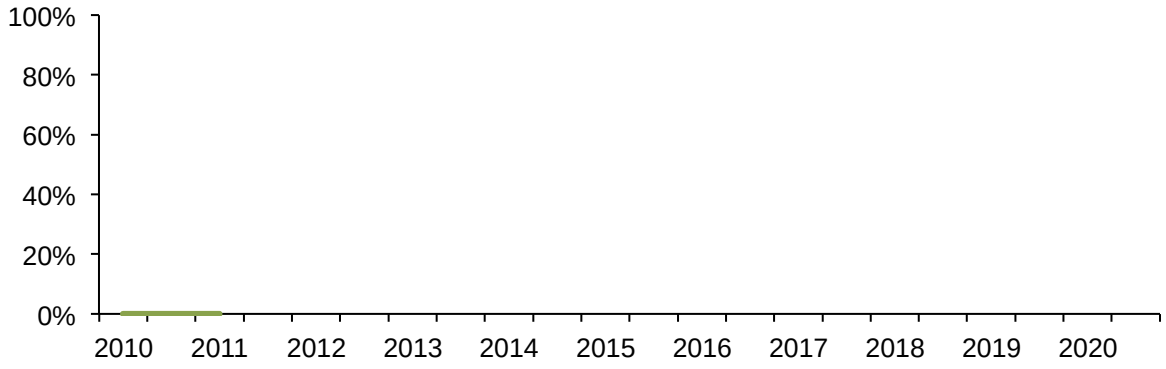


Chart 8, UP1.5: Proportion of blackouts

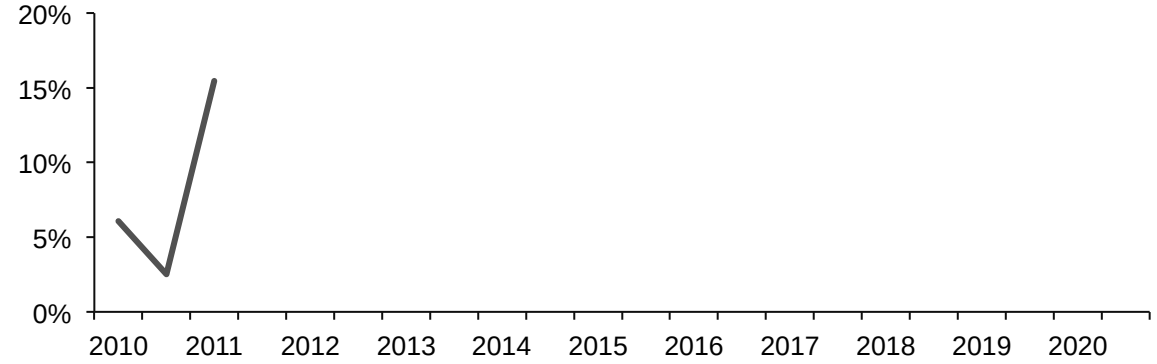


Chart 9, UP1.5: Proportion of load shedding

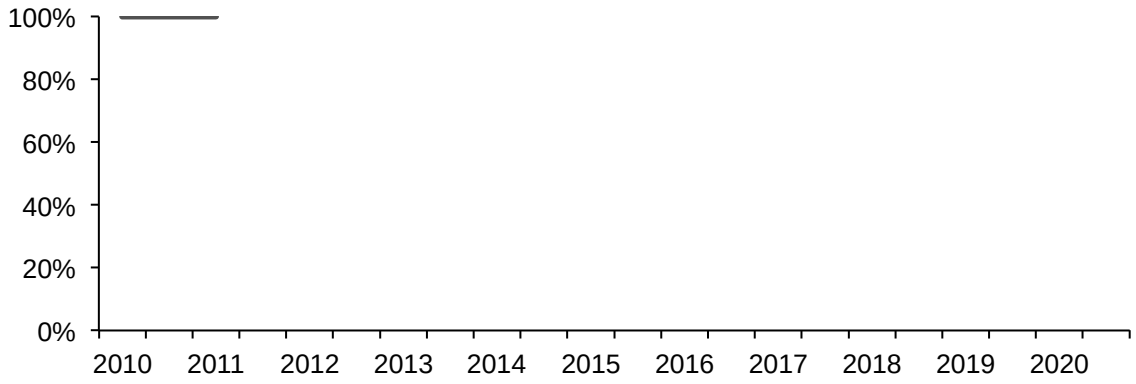


Chart 10, UP1.6: Response time

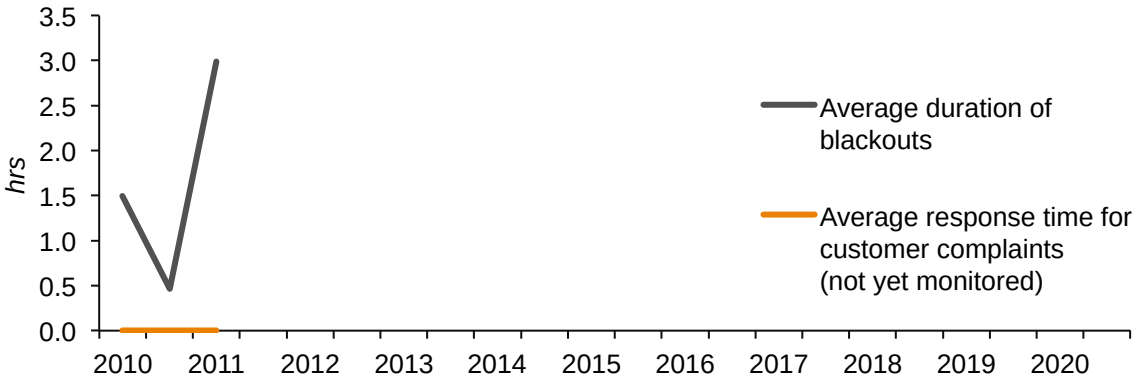
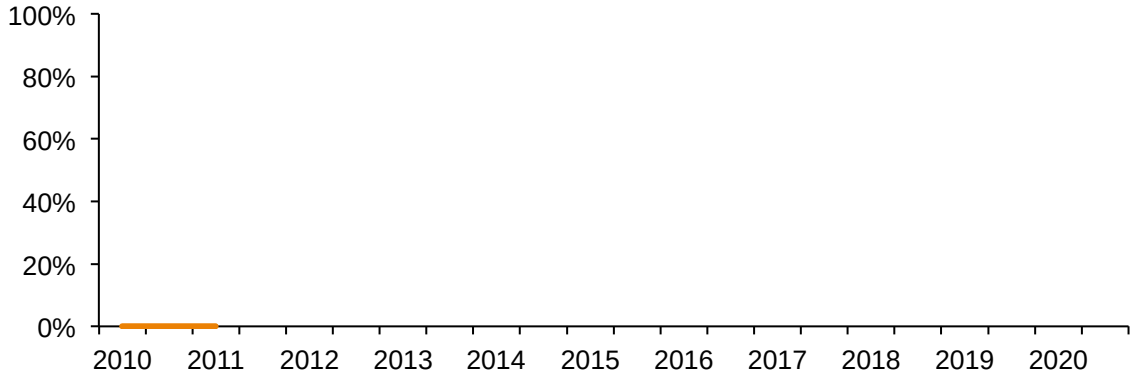


Chart 11, UP1.7: Proportion of prepaid customers



Indicator sheet UP2

Result UP2: Increased demand for electricity and greater awareness of productive energy use, energy efficiency, and energy safety issues		
Indicators	Data elements	Code
(UP2.1) Increased demand for electricity from the WENRECo grid	(1) Overall number of new applications per half year	WE18
	(2) Number of applications over six months old	WE20
(UP2.2) Increased awareness of the potential for productive energy use through the use of electrical appliances	(1) Proportion of households and businesses able to name and explain the function of at least one appliance that can increase their productivity or profit	HH: (IE01) IE04, IE05 B: IE24, IE25
(UP2.3) Increased awareness of energy efficiency measures	(1) Proportion of households that can name at least one energy efficiency measure besides (compact) fluorescent bulbs	SE06, SE07
	(2) Proportion of businesses that can name at least one energy efficiency measure beside (compact) fluorescent bulbs	SE06, SE07
(UP2.4) Awareness of electricity safety issues in households and businesses	(1) Proportion of households that can name at least three (verified) major risks from electricity use (wiring/appliances)	SE04, SE05
	(2) Proportion of businesses that can state at least three (verified) major risks from electricity use (wiring/appliances)	SE04, SE05

Data presentation of UP2

Chart 12, UP2.1: Electricity demand

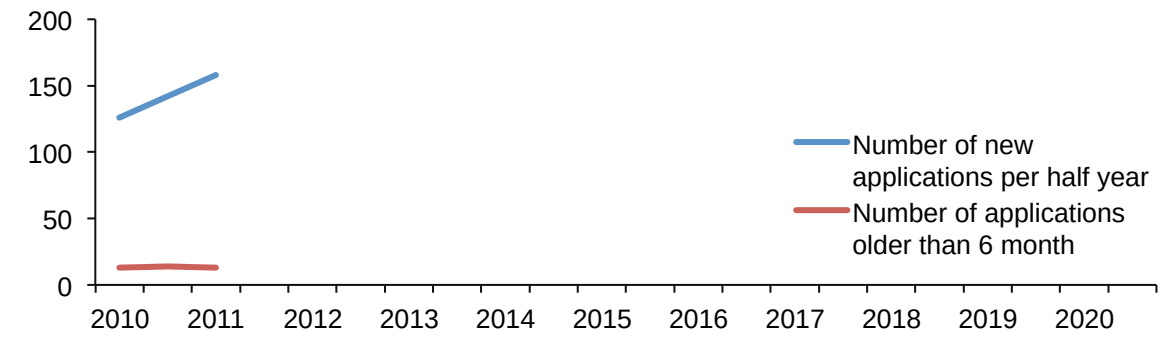


Chart 13, UP2.2: Proportion of households able to name and explain the function of an electrical appliance that can increase their productivity

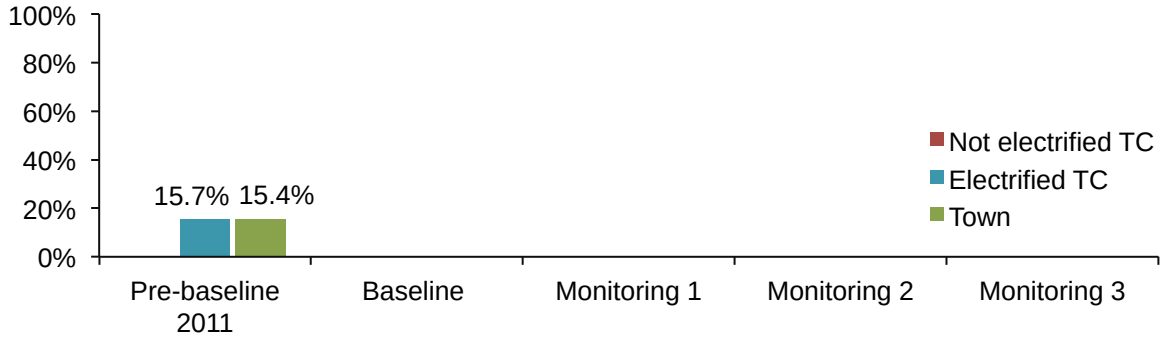


Chart 14, UP2.2: Proportion of businesses able to name and explain the function of an electrical appliance that can increase their productivity

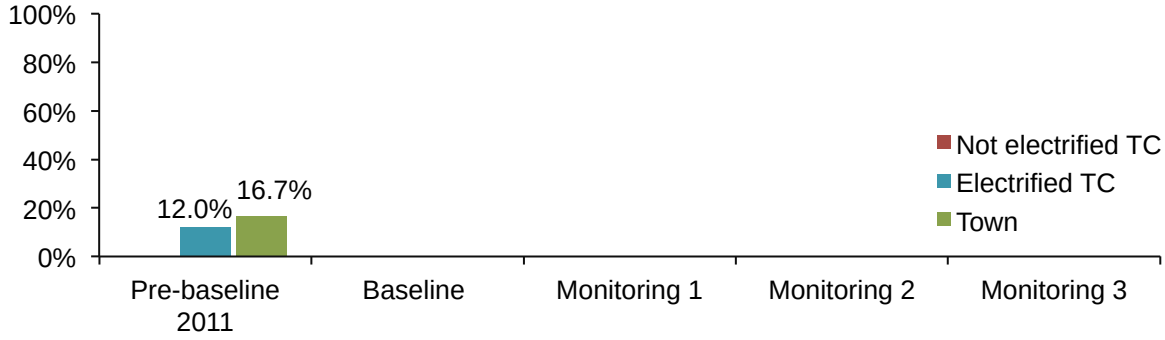


Chart 15, UP2.3: Proportion of households who can name at least one energy efficiency measure

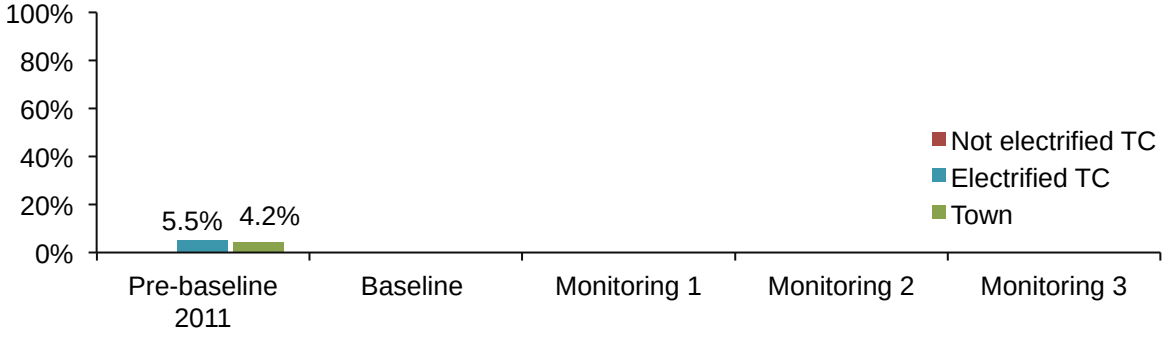


Chart 16, UP2.3: Proportion of businesses who can name at least one energy efficiency measure

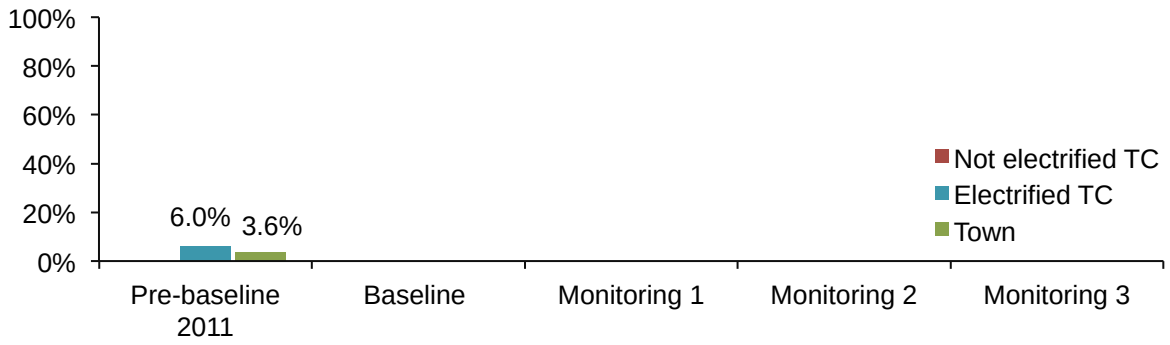


Chart 17, UP2.4: Proportion of households that can name at least three main risks of electricity use

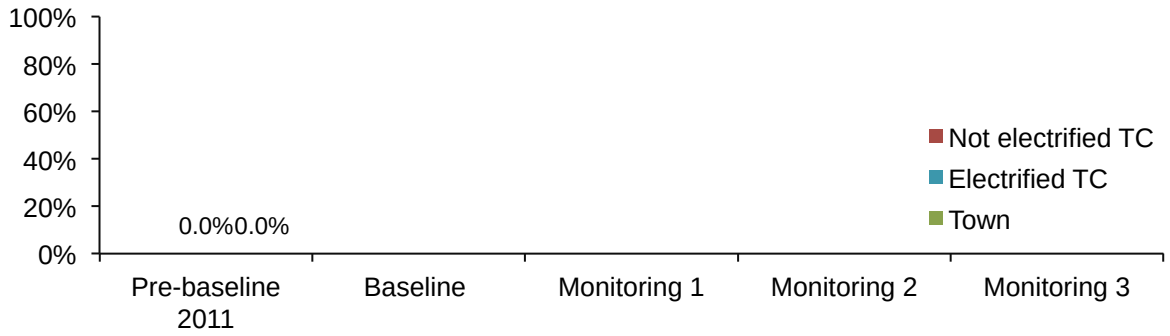
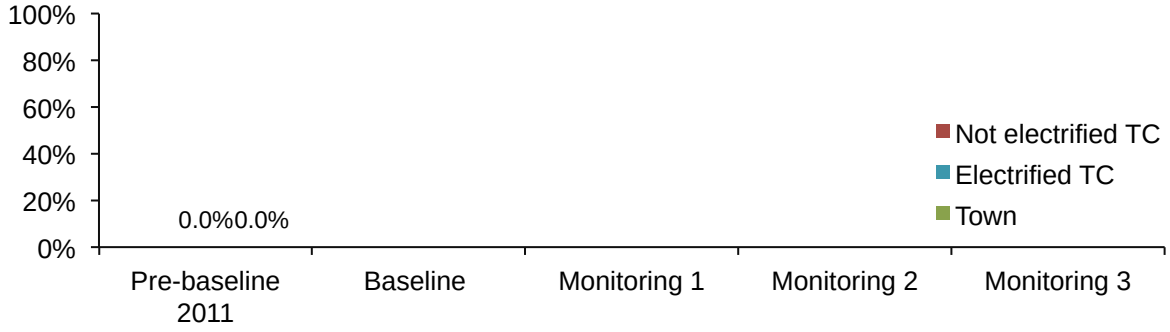


Chart 18, UP2.4: Proportion of businesses that can name at least three main risks of electricity use



2.3 Indicator sheets – Outcome level

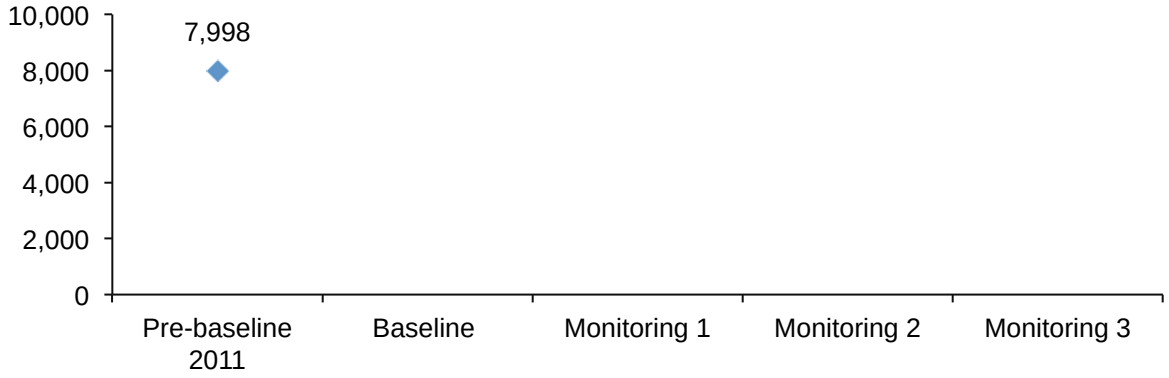
This chapter presents the status of the indicators at Outcome level. These allow the situation regarding the programme's main goals to be established and whether activities have achieved the results desired. In contrast with the indicator sheets at Output and Use of Output level, a discussion on each indicator also has been included. Furthermore, each indicator sheet also provides relevant definitions, information on the data source, the name of the indicator calculation spreadsheet, and details on the data elements.

Indicator sheet OC1.1

Result OC1: Improved access to and better use of electricity-based services		
Indicator	(OC 1.1) The number of beneficiaries who are directly connected to the electricity grid has increased	
Definitions	*Directly connected beneficiaries* are all people living in households that have or share a direct electricity connection.	
Discussion	*Rationale*: the calculation of number of beneficiaries translates the number of connections to the island grid into the number of individuals actually benefiting from access to electricity-based services. However, considering the varying degrees of access and to avoid double counting, only household members are included for indicator calculation. Calculations are based on the number of connections for households as provided by WENRECo, the average number of households that share an electricity connection and the average household size, which is established during the field survey. The mean household size is cross-checked with statistical data from UBoS. *Limitations*: the indicator cannot provide a precise number of beneficiaries, as the data elements are based on average numbers for household members in West Nile. Finally, the number does not only refer to the grid extension area but to the complete grid-electrified area in West Nile.	
Source	WENRECo, field survey: households	
Indicator calculation	Indicator_OC1.1.xlsx	
Data elements and variable code	Number of households connected to the grid	WE05
	Average number of neighbours additionally connected per connected household	HH: GI11
	Average number of members per household in connected areas (5.2 according to UBoS 2010: 9)	

Data presentation for OC1.1

Chart 19, OC1.1: Beneficiaries in terms of members of connected households



Indicator sheet OC1.2

Result OC1: Improved access to and better use of electricity-based services		
Indicator	(OC1.2) In electrified areas, the average number of electrical appliances used in households, businesses, schools and health centres has increased compared to business-as-usual	
Definitions	*Electrical appliances* include appliances in various categories, such as appliances for (i) lighting, (ii) heating, (iii) cooling, (iv) ICT (information, entertainment, communication, computer, internet), (v) mechanical power, (vi) charging, and (vii) medical appliances used in health centres. However, battery-powered appliances, such as torches, or appliances which only run on solar power, such as solar lamps, are excluded.	
Discussion	*Rationale*: electricity can only be transformed into the electrically powered services that people need through appropriate appliances. Hence, the number of electrical appliances reflects the extent of access in terms of availability, affordability, and even quality, if certain assumptions hold true. The relevant data is collected during the field survey. *Limitations*: this is an index type of indicator. All electrical appliances are put into one average, so detailed information on the different types of appliances in use (and hence on the electricity services required) is not presented. However, disaggregated information can still be drawn from the database. Furthermore, certain assumptions have to be made, e.g. for lighting: if any electrical appliance is used, the energy service is already improved, even though the data set does not provide details on specific conditions, such as wall colour or the size of the room to be lit. The latter would have gone far beyond the scope of the questionnaires and proved unmanageable.	
Source	Field survey: households, businesses, schools, health centres	
Indicator calculation	data_base.xlsx and indicator_OC1.2.xlsx	
Data elements and variable codes	Average number of electrical appliances used in households	AP01 to AP109 (excluding AP02 and AP04)
	Average number of electrical appliances used in businesses	AP01 to AP109 (excluding AP02 and AP04)
	Average number of electrical appliances used in schools	AP01 to AP106 (excluding AP02 and AP04)
	Average number of electrical appliances used in health centres	AP01 to AP126 (excluding AP21 and AP23)

Data presentation for OC1.2

Chart 20, OC1.2: Average number of electrical appliances used in a household

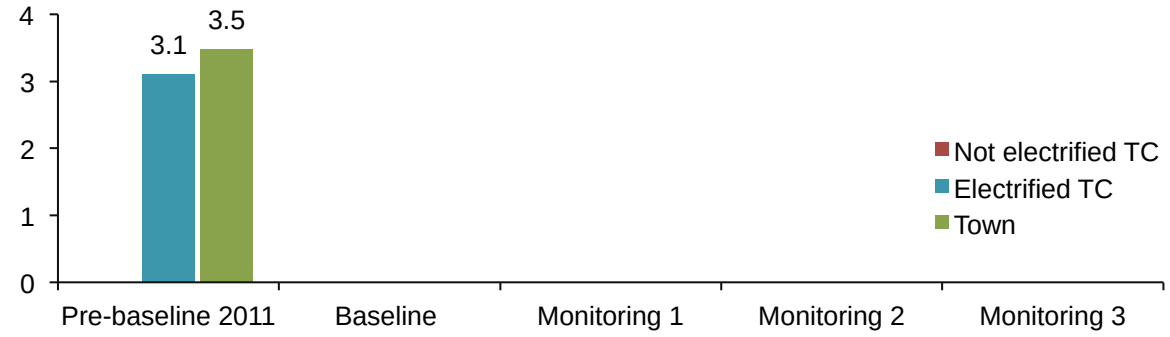


Chart 21, OC1.2: Average number of electrical appliances used in a business

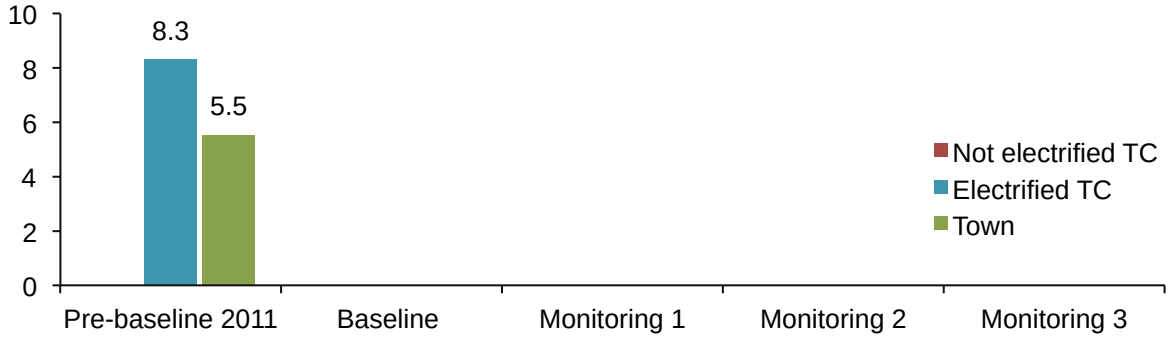


Chart 22, OC1.2: Average number of electrical appliances used in a health centre

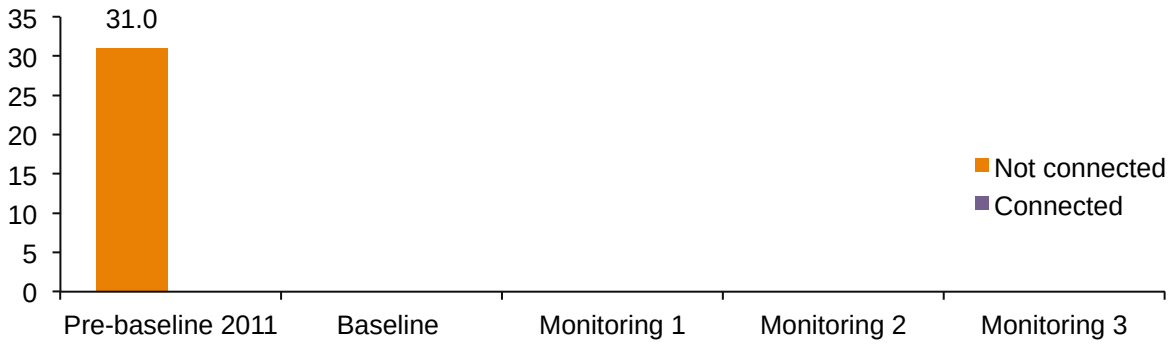
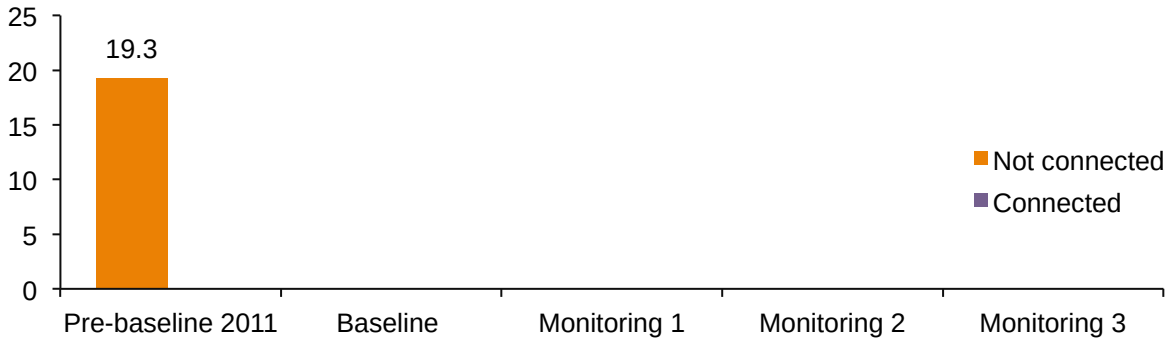


Chart 23, OC1.2: Average number of electrical appliances used in a secondary school



Indicator sheet OC1.3

Result OC1: Improved access to and better use of electricity-based services		
Indicator	(OC1.3) In electrified areas households, businesses, schools and health centres have reduced their fossil energy consumption and their use of biomass compared to business-as-usual	
Definitions	*Fossil energies*: include diesel, petrol, kerosene/petroleum/paraffin, candles, gas (LPG) *Biomass*: include firewood, charcoal, animal dung, crop residues	
Discussion	*Rationale*: improved access to electricity is assumed to lead to the substitution of fossil and/or biomass energy sources to meet energy service needs. Hence a reduction of the quantity and frequency of use of fossil and biomass energy sources is expected, and is used as an indicator for the gradual move from fossil fuels and biomass to electricity. The data needed to calculate the indicator is collected during the field survey. Information is collected on the most commonly used energy sources. As the conversion of biomass used into units of energy cannot be standardised, only the frequency of use of any biomass energy source is calculated. *Limitations*: a reduction in fossil fuel or biomass usage could also arise as a result of substitution with solar energy, or due to budget constraints; this cannot be separated within the aggregated indicator presentation. Furthermore, the indicator does not allow any detailed statements regarding which energy services are substituted by the conversion of which energy source.	
Source	Field survey: households, businesses, schools, health centres	
Indicator calculation	indicator_OC1.3.xlsx	
Data elements and variable code	Quantity of fossil energy sources used for stationary combustion in households, businesses, schools and health centres	HH, B, HC, S: EF01 to EF29
	Proportion of households, businesses, schools and health centres using biomass energy sources (firewood, charcoal, animal dung, crop residues)	HH, B, HC, S: EF34 to EF47
	Conversion factors	Annex (Table 14)

Data presentation for OC1.3

Chart 24, OC1.3: Quantity (MJ) of fossil fuels used by a household on average per month

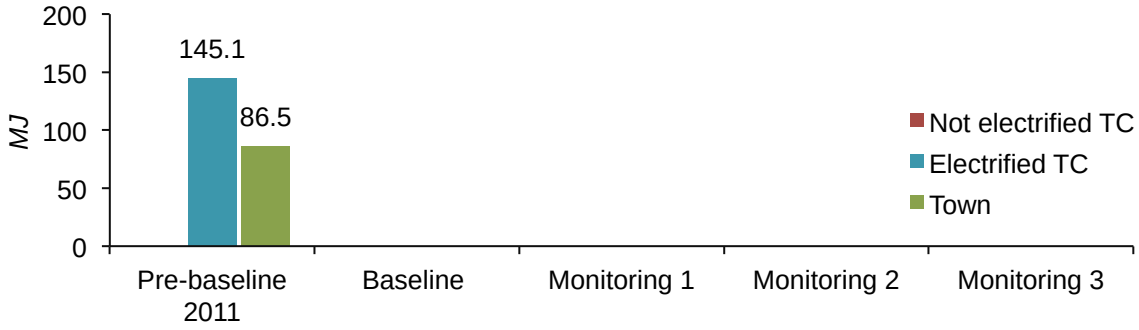


Chart 25, OC1.3: Quantity (MJ) of fossil fuels used by a business on average per month

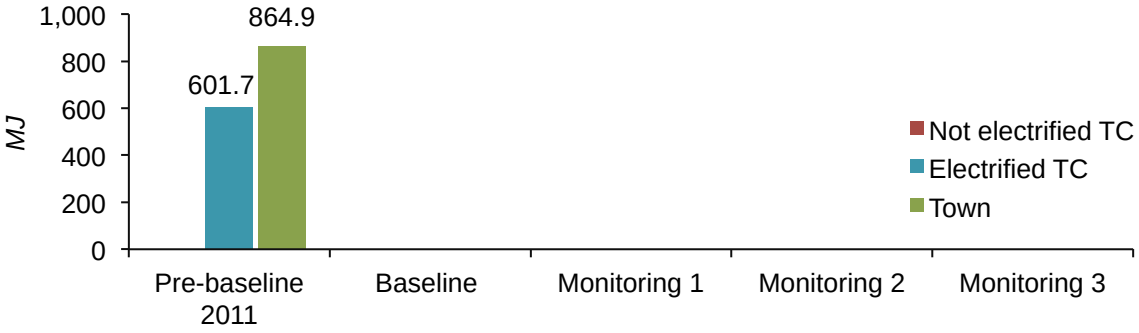


Chart 26, OC1.3: Quantity (MJ) of fossil fuels used by a health centre on average per month

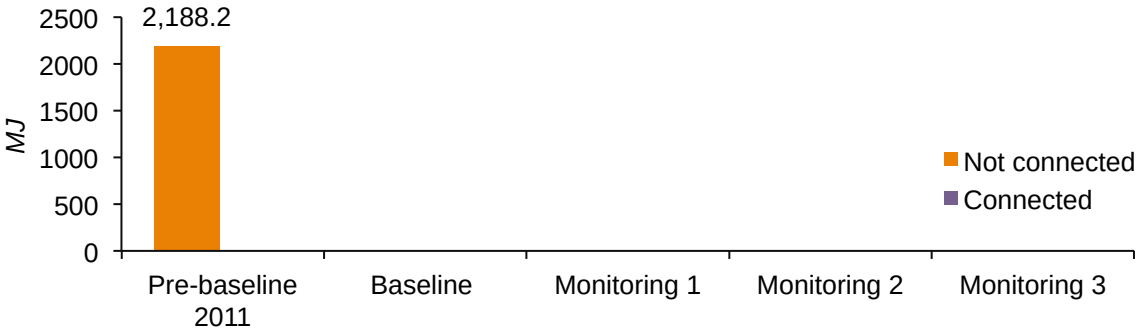


Chart 27, OC1.3: Quantity (MJ) of fossil fuels used by a secondary school on average per month

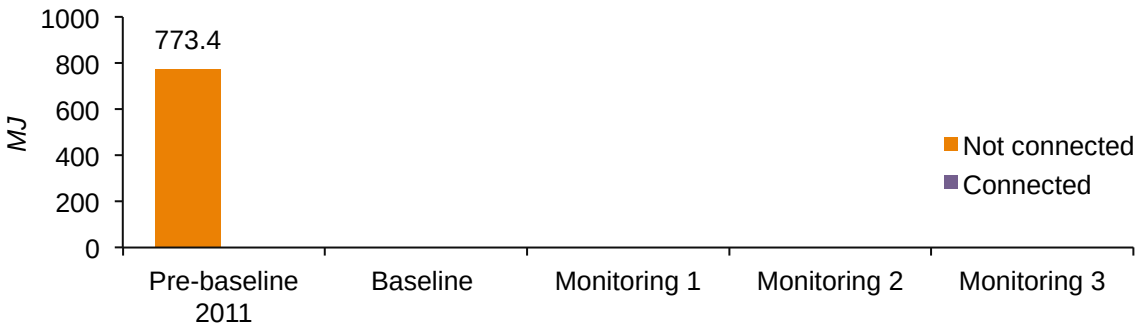


Chart 28, OC1.3: Proportion of households using biomass

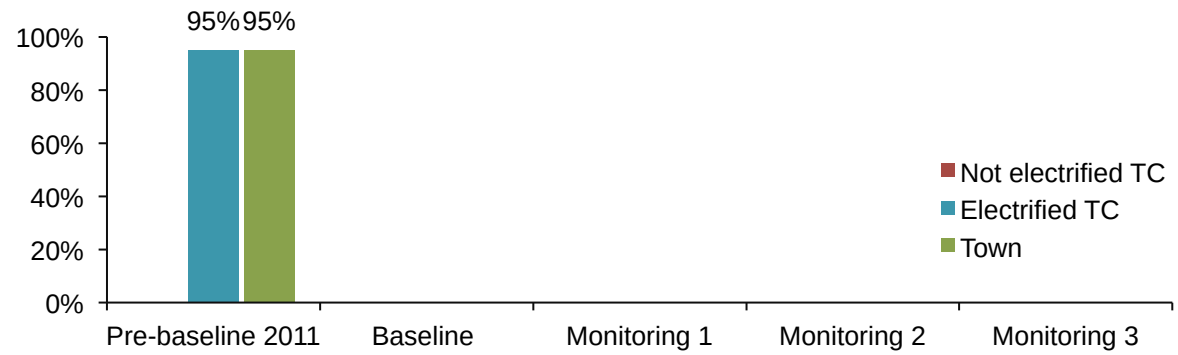


Chart 29, OC1.3: Proportion of businesses using biomass

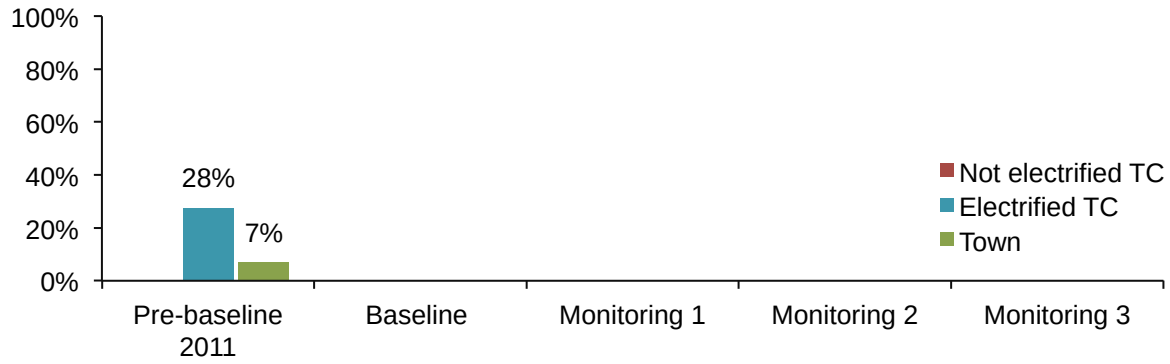


Chart 30, OC1.3: Proportion of health centres using biomass

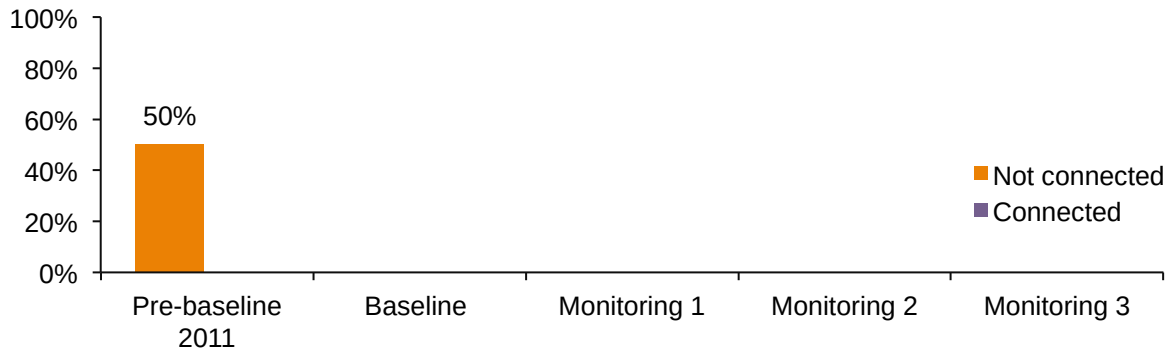
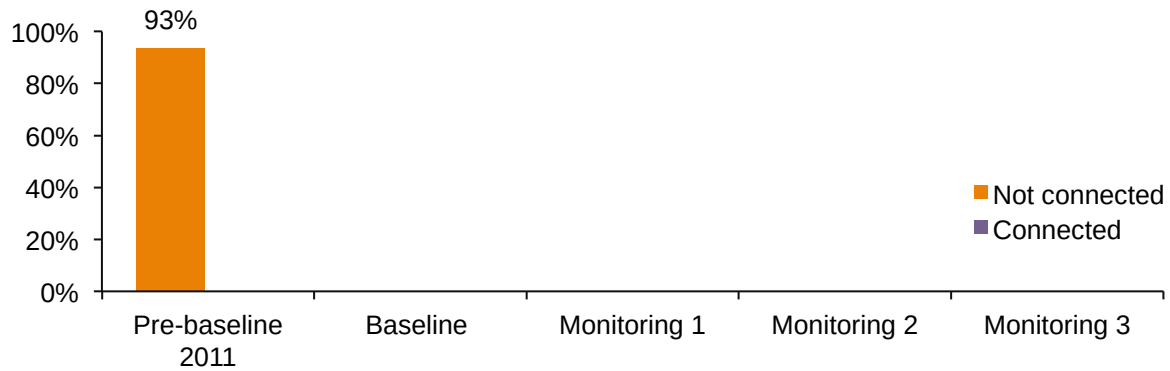


Chart 31, OC1.3: Proportion of secondary schools using biomass



Indicator sheet OC1.4

Result OC1: Improved access to and better use of electricity-based services		
Indicator	(OC1.4) In electrified areas, the number of households and businesses that are not able to pay for their monthly electricity consumption from the island grid remains low	
Discussion	*Rationale*: this indicator reflects the affordability dimension of access. Improved access to electricity-based services can only be assumed if connected households and businesses can constantly afford their electricity consumption. It was not necessary to collect the information needed from households and businesses as it is available direct from the electricity provider. *Limitations*: this indicator does not capture aspects of preferences. It is assumed that households and businesses desire a constant supply and that the amount of their consumption reflects their total need. If the proportion of unpaid bills increases, further data will need to be collected using additional instruments.	
Source	Field survey: households, businesses; WENRECo	
Indicator calculation	Indicator_OC1.4.xlsx	
Data elements and variable code	Average number of times per year that households and businesses were disconnected	HH: GI09 B: IE33, IE30
	Percentage of disconnect orders enforced by WENRECo per half-year, relative to the total number of connected customers	WE08, WE41
	Number of pre-paid meters which have a zero balance for more than one month per half-year	WE42

Data presentation for OC1.4

Chart 32, OC1.4: Times per year that a household is disconnected on average

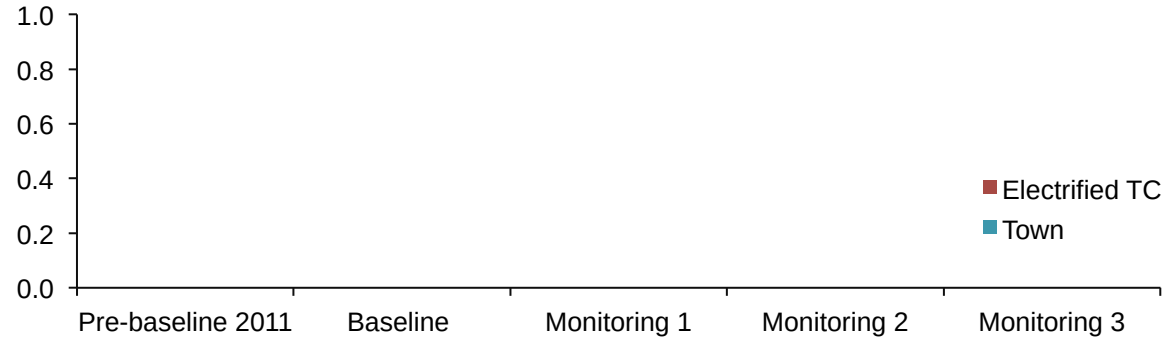


Chart 33, OC1.4: Times per year that a business is disconnected on average

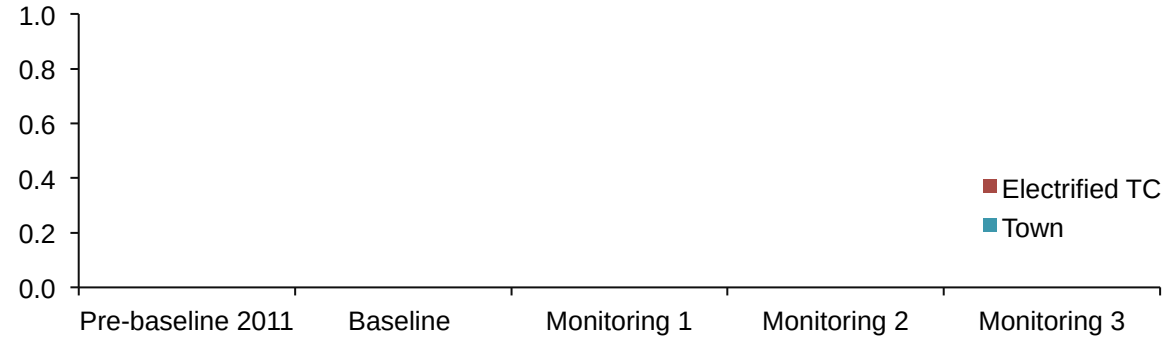


Chart 34, OC1.4: Percentage of implemented disconnect orders, relative to the total number of connected customers

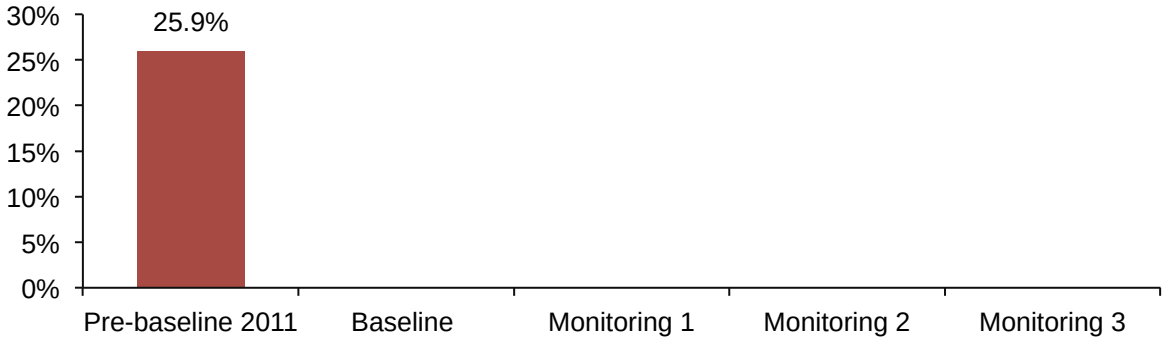
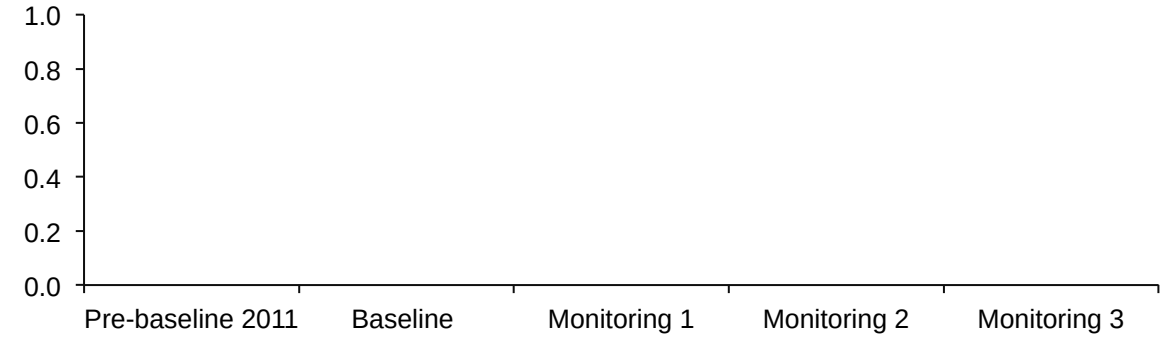


Chart 35, OC1.4: Number of pre-paid meters which have a zero balance for more than one month per half-year

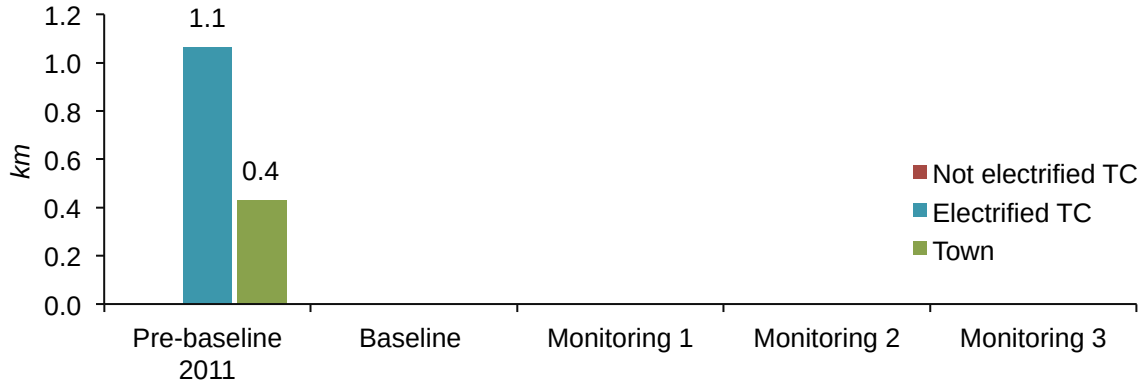


Indicator sheet OC1.5

Result OC1: Improved access to and better use of electricity-based services		
Indicator	(OC1.5) Households in electrified areas are better able to satisfy their ICT service needs compared to business-as-usual	
Definitions	*ICT service needs*: ICT is the abbreviation for Information and Communication Technology. Key ICT services which most households are assumed to need include electricity for charging mobile phones, photocopying, powering computers, and facilitating computer-based internet access.	
Discussion	*Rationale*: this indicator allows both the direct and indirect aspects of improved access to be measured. On the one hand, an individual connection provides the opportunity to satisfy individual ICT service needs at that location. On the other hand, market mechanisms and business development can bring these services closer to users. This reduces the overall effort individuals need to make in order to satisfy their ICT service needs, which in turn improves access to electricity based services. The data required is captured during the field survey by directly interviewing households. *Limitations*: this is an index type of indicator. All distances are put into one average; hence detailed information on the different distances to the services becomes lost. However, disaggregated information can still be obtained from the database. Furthermore, the indicator does not capture information about the actual level of demand for these specific services.	
Source	Field survey: households	
Indicator calculation	indicator_OC1.5.xlsx	
Data elements and variable codes	Average distance to key electricity-based services (nearest place to charge mobile phones, to copy or print, to use a computer, and to access the internet with a computer)	AP126, AP127, AP128, AP129

Data presentation for OC1.5

Chart 36, OC1.5: Average distance to key ICT services



Indicator sheet OC1.6

Result OC1: Improved access to and better use of electricity-based services		
Indicator	(OC1.6) In electrified areas, accidents caused by electricity use which lead to serious injuries, death or property damage have reduced compared to business-as-usual	
Definitions	*Accidents caused by electricity:* refers to serious and fatal accidents due to electricity (e.g. caused by electric shock, short circuits, fires caused by poor wiring) as well as fire outbreaks on the premises.	
Discussion	*Rationale*: unsafe practices in electricity use can cause serious and even fatal injuries. A fall in these numbers reflects safer (hence better) use of electricity-based services. The use of biomass and fossil energy sources in the region frequently leads to the outbreak of fire. The increased use of electricity to satisfy energy service needs can thus reduce the number of fires and in turn make better use measurable. *Limitations*: the data on the number of fire outbreaks does not-specifically capture the cause of the fire.	
Source	Field survey: households, businesses	
Indicator calculation	Indicator_OC1.6.xlsx	
Data elements and variable code	Average number of people who died due to accidents involving electricity in households and businesses within the last twelve months	HH, B: SE11
	Average number of people who were seriously injured due to accidents involving electricity in households and businesses within the last twelve months	HH, B: SE10
	Average number of fire outbreaks in households and businesses within last twelve months	HH, B: SE01

Data presentation for OC1.6

Chart 37, OC1.6: Number of fire outbreaks in premises of a household within 12 months on average

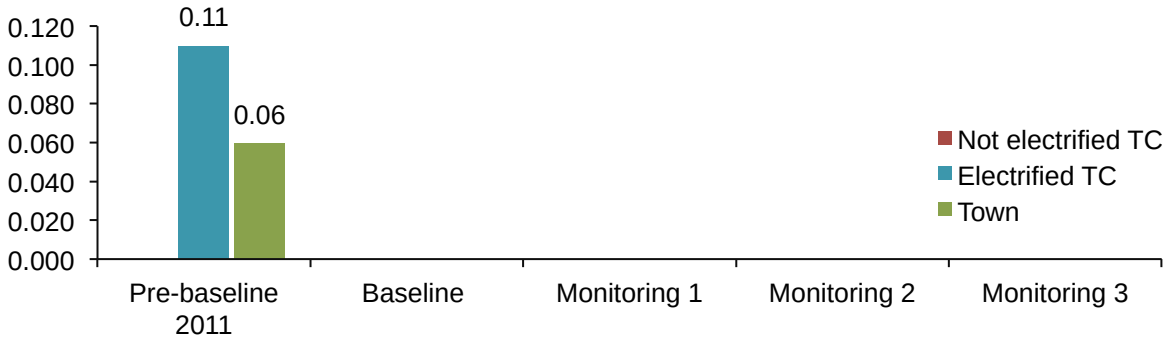


Chart 38, OC1.6: Number of people who were seriously injured due to accidents with electricity in a household within 12 months on average

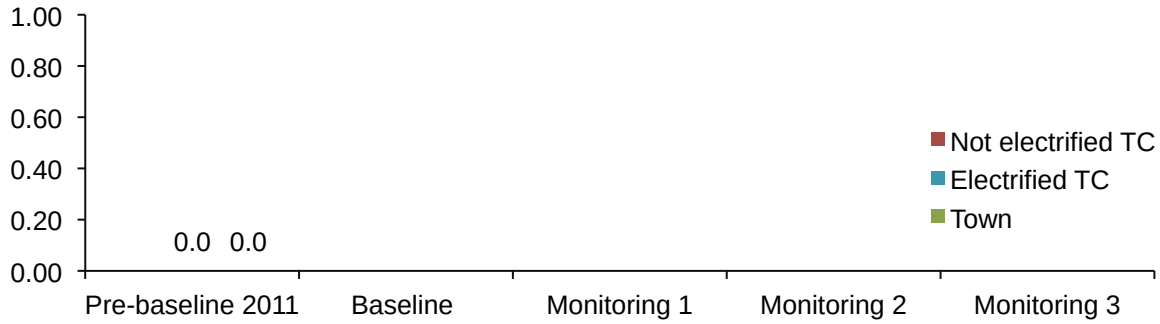


Chart 39, OC1.6: Number of people who died due to accidents with electricity in households within 12 months on average

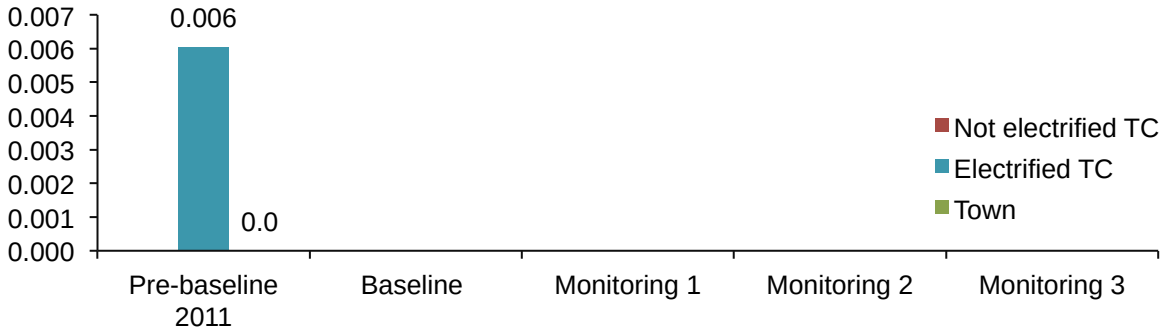


Chart 40, OC1.6: Number of fire outbreaks in premises of a business within 12 months on average

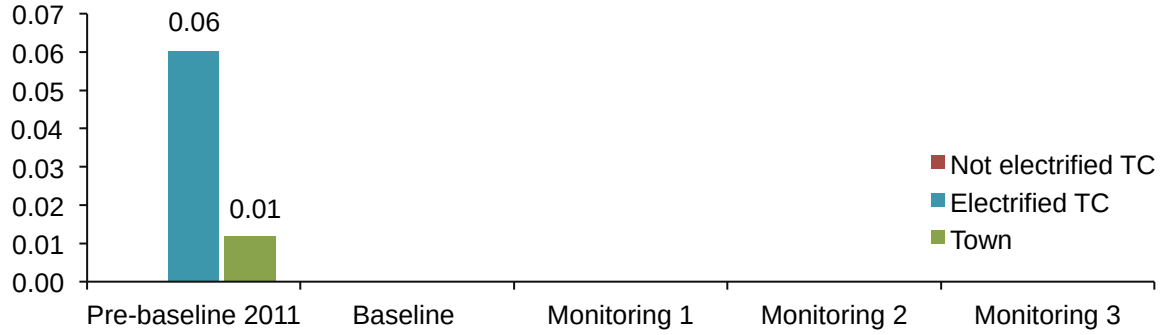


Chart 41, OC1.6: Number of people who were seriously injured due to accidents with electricity in a business within 12 months on average

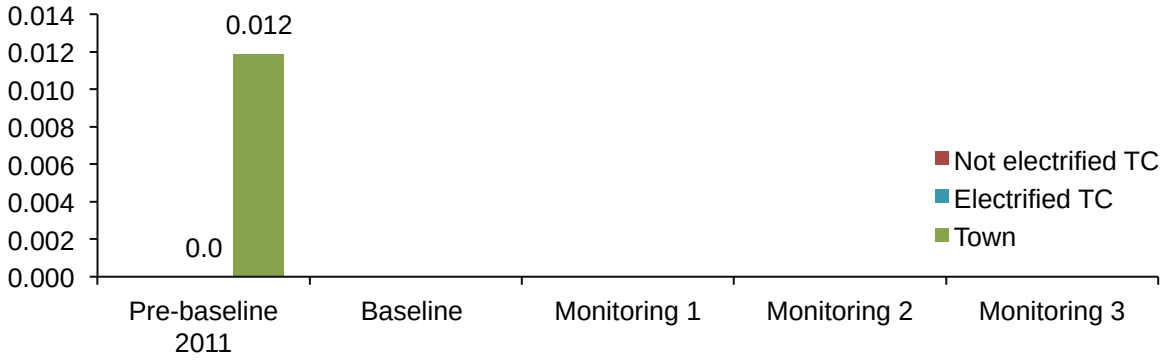
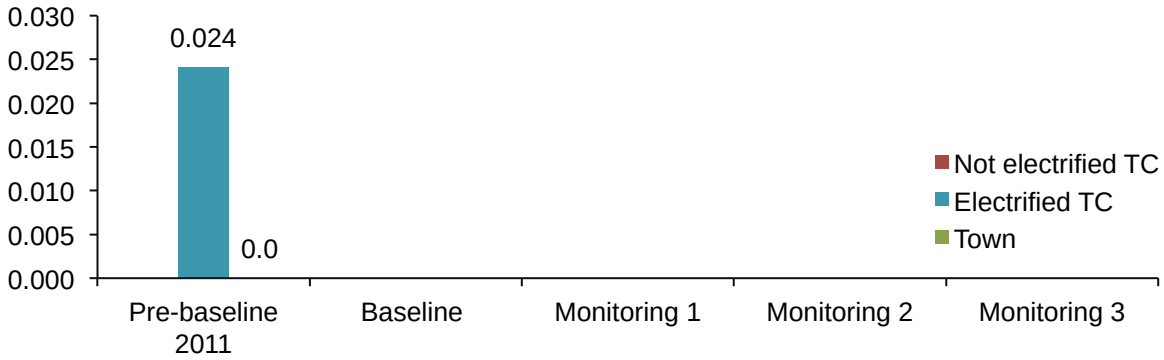


Chart 42, OC1.6: Number of people who died due to accidents with electricity in a business within 12 months on average



Indicator sheet OC1.7

Result OC1: Improved access to and better use of electricity-based services		
Indicator	(OC1.7) In electrified areas, electricity-saving measures implemented by households and businesses have increased compared to business-as-usual	
Definitions	*Energy-saving measures:* refer to certain behaviour and measures to reduce the use of electricity needed to produce the same level of output	
Discussion	*Rationale*: the implementation of electricity-saving measures, such as the use of energy-saving bulbs or switch off appliances when not used, reflects a change not just in attitude but also in behaviour. *Limitations*: the indicator is based on revealed behaviour to a limited extent only (number of bulbs); it also relies on stated behaviour, which could be biased and is not cross-checked.	
Source	Field survey: households, businesses	
Indicator calculation	Indicator_OC1.7.xlsx	
Data elements and variable code	Proportion of households and businesses that have implemented at least one energy-saving measure, in addition to energy-saving bulbs	HH, B: SE08, SE09
	Proportion of energy-saving bulbs of all electric lights used in an average of households and businesses	HH, B: AP01, AP03

Data presentation for OC1.7

Chart 43, OC1.7: Proportion of households that implemented at least one energy saving measure, besides energy saving bulbs

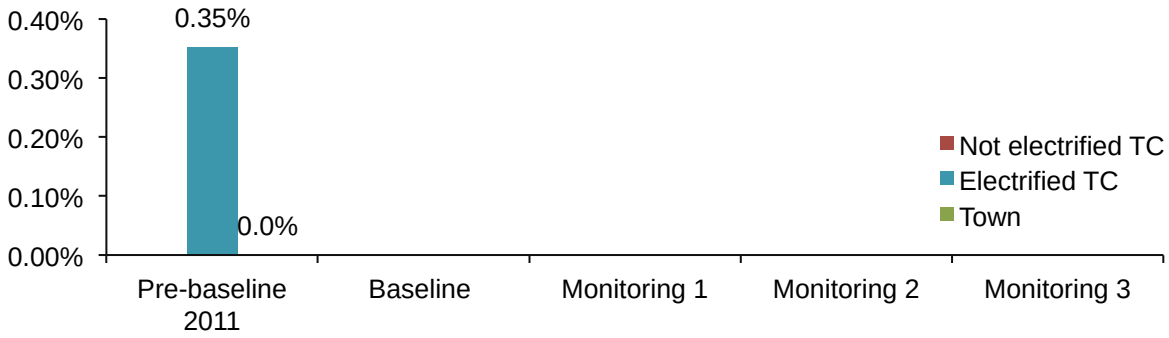


Chart 44, OC1.7: Proportion of energy saving bulbs of all electric lamps used in an average household

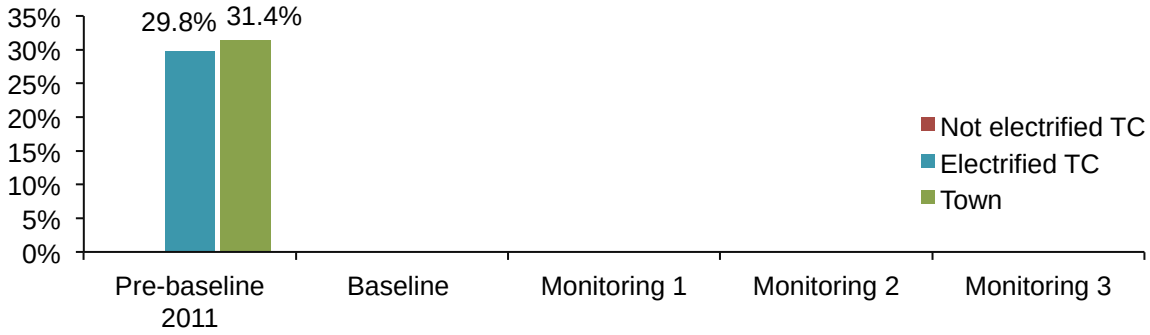


Chart 45, OC1.7: Proportion of businesses that implemented at least one energy saving measure, besides energy saving bulbs

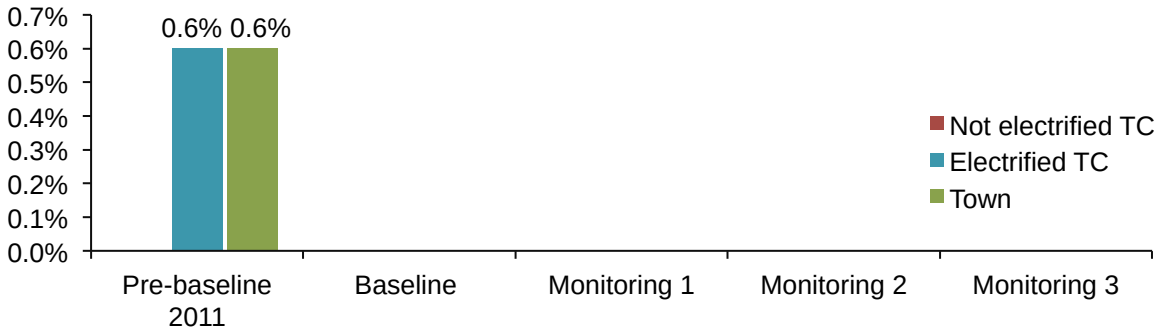
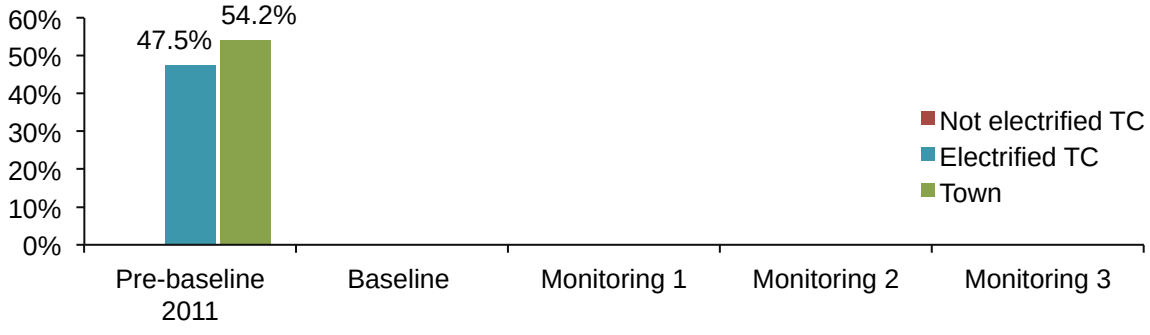


Chart 46, OC1.7: Proportion of energy saving bulbs of all electric lamps used in an average business



2.4 Indicator sheets – Impact level

This chapter provides an overview on the status of the indicators at Impact level. Despite the challenges of the attribution gap, these assess the long-term effects of the electrification programme in West Nile (see I–4.3). As with the Outcome level indicator sheets, each indicator is discussed in brief, and information is provided on data source, data elements, indicator calculation, and variable codes.

Indicator sheet I1.1

Result I1: Reduction of CO_2 emissions from stationary combustion of fossil fuels		
Indicator	(I1.1) CO_2 emissions from the stationary combustion of fossil fuels for grid electricity generation have been reduced in both absolute and relative terms	
Definitions	*Stationary combustion*: combustion of fossil fuels to generate heat, power and electricity for stationary use (no transport)	
Discussion	*Rationale*: the indicator refers to the direct link between fossil fuel combustion and CO_2 emission. The substitution of the WENRECo heavy oil fuel generator by Nyagak I and III will contribute significantly to the reduced use of fossil fuels for electricity generation in the region. Absolute emissions could also fall as a result of lower overall electricity generation; therefore, to avoid biased reduction statistics, relative emissions per kWh of electricity produced are included as well. *Limitations*: the application of standardised conversion factors will lead to a general uncertainty in the calculated values. Other greenhouse gas emissions are not included into the calculations, due to their variability and dependence on the mode of combustion.	
Source	WENRECo	
Indicator calculation	indicator I1.1.xlsx	
Data elements and variable codes	Amount [kg] of diesel used for electricity generation by WENRECo per half-year	WE01
	Amount [kg] of heavy fuel used for electricity generation by WENRECo per half-year	WE02
	Conversion factors [CO_2 per kg]	Annex (Table 14)
	MWh generated by WENRECo	WE40

Data presentation for I1.1

Chart 47, I1.1: CO_2 emissions of WENRECo

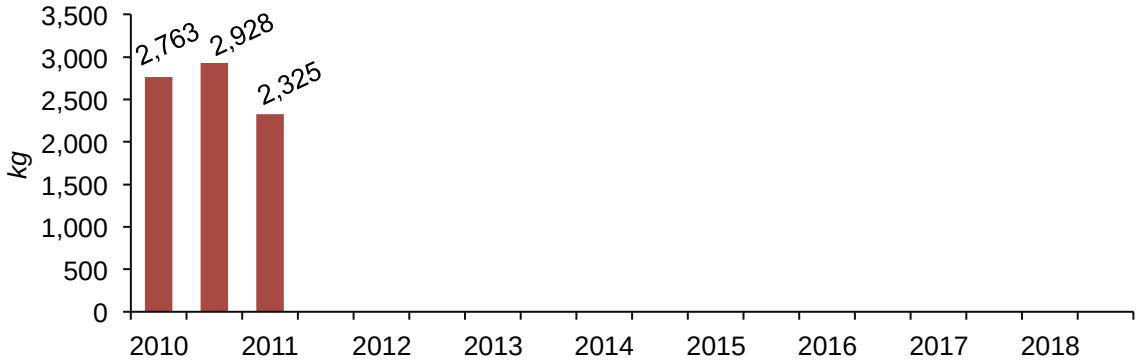
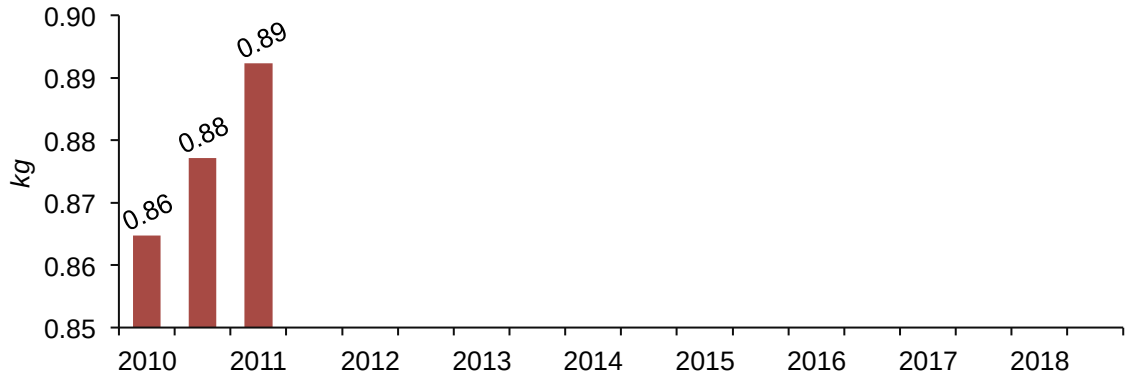


Chart 48, I1.1: CO_2 emissions per KWh produced by WENRECo



Indicator sheet I1.2

Result I1: Reduction of CO_2 emissions from the stationary combustion of fossil fuels		
Indicator	(I1.2) In electrified areas CO_2 emissions from the stationary combustion of fossil fuels have been reduced compared to business-as-usual	
Definitions	*Stationary combustion:* combustion of fossil fuels to generate heat, power and electricity for stationary use (excludes fuel used for transport)	
Discussion	*Rationale*: this indicator refers to the direct link between fossil fuel combustion and CO_2 emissions. As well as the electricity supplier WENRECo, other user of electricity-based services will also reduce their CO_2 footprint, as energy services generated from fossil fuels are replaced by renewably generated electricity. *Limitations*: fuel combustion to generate heat for cooking also results in substantial CO_2 emissions, and it is less likely that these will be replaced by the use of electricity in the near future. Even though most households also use biomass as fuel, there are three reasons that impede its inclusion in CO_2 emissions monitoring: (1) the heating value of biomass varies strongly according to its type and humidity, making measurement very complicated, (2) climate-relevant emissions from biomass vary substantially according to the type and management of the combustion process, and this cannot be monitored, and (3) biomass might or might not be a renewable resource depending on how it is produced, which again cannot be monitored.	
Source	Field survey: households, businesses, schools, health centres	
Indicator calculation	indicatorI1.2xlsx	
Data elements and variable codes	Volume of diesel [l], petrol [l], kerosene/paraffin [l], LPG [kg], and paraffin wax [kg candles] used for energy services (other than transport) by households, businesses, schools and health centres	HH, B, HC, S: EF01 to EF21
	Conversion factors	Annex (Table 14)

Data presentation for I1.2

Chart 49, I1.2: Average CO_2 emissions of a household per month

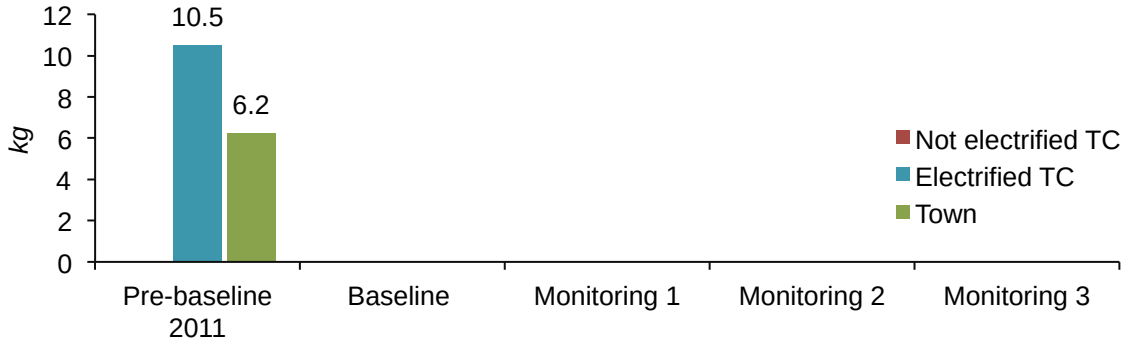


Chart 50, I1.2: Average CO_2 emissions of a business per month

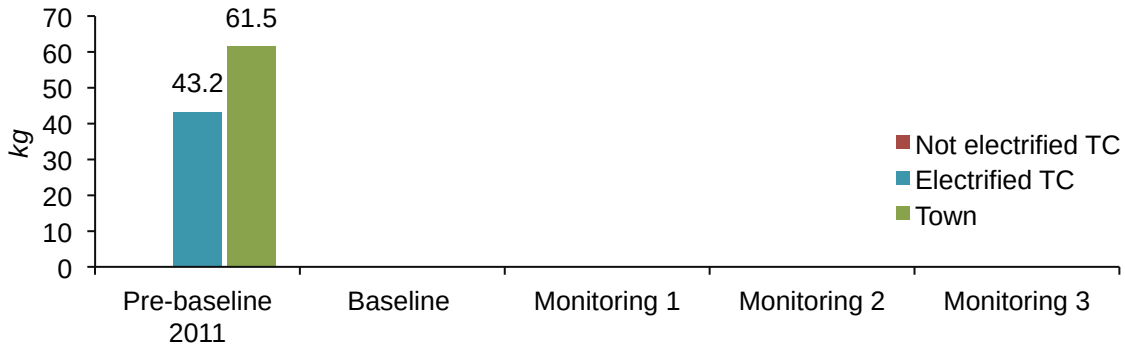


Chart 51, I1.2: Average CO_2 emissions of a health centre per month

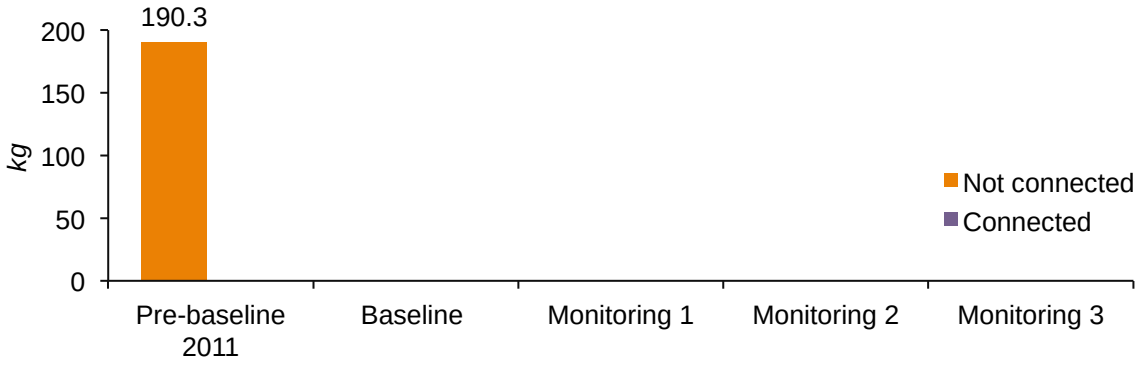
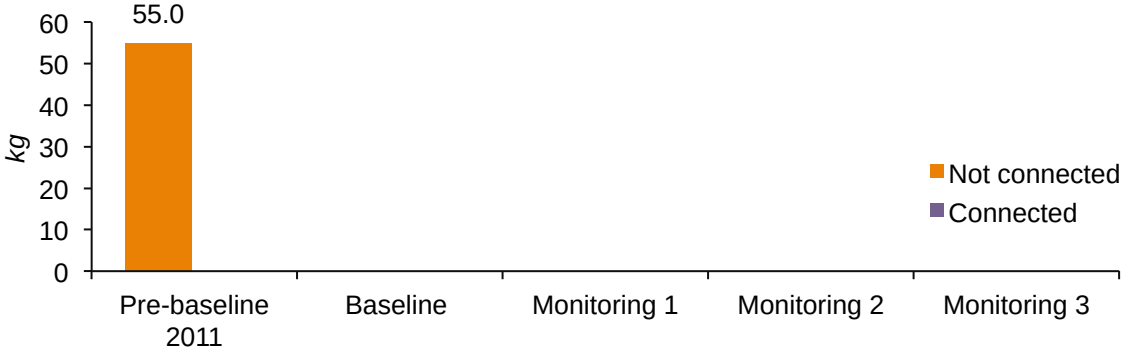


Chart 52, I1.2: Average CO_2 emissions of a secondary school per month



Indicator sheet I2.1

Result I2: Increased productive and income-generating activities		
Indicator	(I2.1) In electrified areas, businesses have expanded their productive and commercial activities in terms of number of employees and length of business hours compared to business-as-usual	
Definitions	*Businesses*: describes all businesses and income-generating activities that go beyond household activities, have a stationary place of business, and operate on a regular basis. The definition excludes taxi services, but includes small kiosks.	
Discussion	*Rationale*: the number of employees reflects the scope of business activities and potential turnover. Generally, increased business hours allow for a longer period of income generation, and a higher number of employees allows for an increased volume of activity. *Limitations*: employee qualification levels are an important aspect for business success which is not captured by the indicator. Only permanent employees are included into the indicator calculation, and seasonal changes in the number employed are not reflected. For production and manufacturing businesses, the investment in electrical machines and appliances might also lead to a reduction in employees. An analysis of the indicator for these specific typed of business lines could inform discussion of the results.	
Sources	Field survey: businesses	
Indicator calculation	data_base.xlsx and indicator I2.1.xlsx	
Data element and variable codes	Number of permanent employees in businesses	IE08
	Business hours of businesses [hrs/week]	IE15, IE16, IE17, IE18

Data presentation for I2.1

Chart 53, I2.1: Average number of employees including the owner of a business

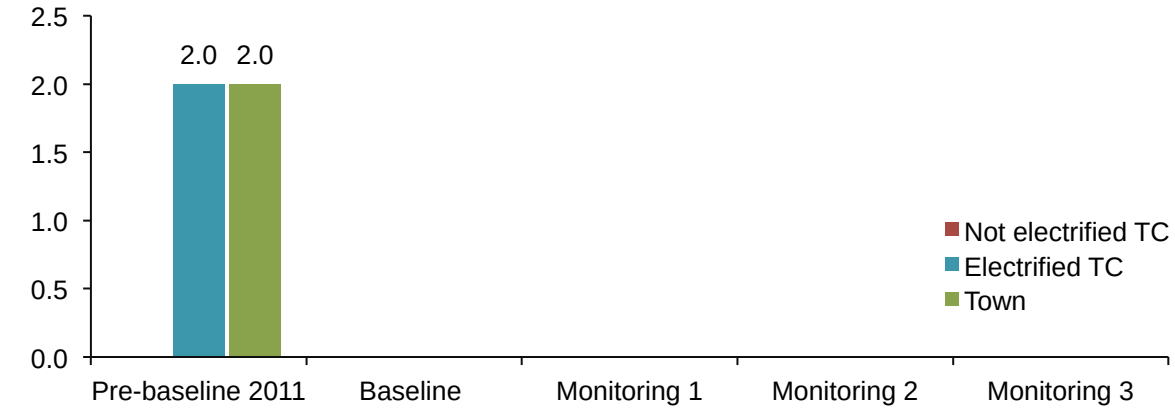
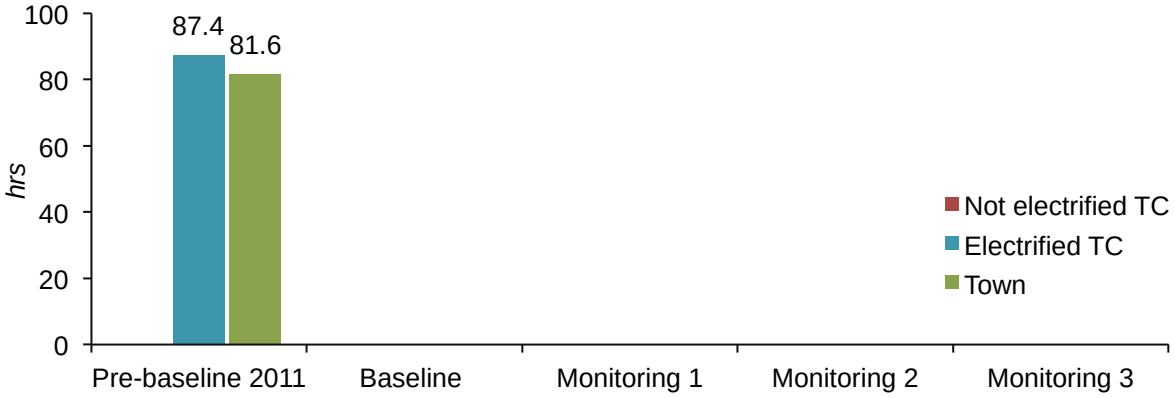


Chart 54, I2.1: Average weekly business hours of a business



Indicator sheet I2.2

Result I2: Increased productive and income-generating activities		
Indicator	(I2.2) In electrified areas, productive activities have increased, in terms of the proportion of lines of businesses which have local value adding	
Definitions	*Line of business*: production/manufacturing (the production of tangible goods), food processing (a special production category, included because of its high potential in rural areas), service (the production of intangible goods), retail and wholesale. *Value adding/regional income*: 'value adding' means to increase the value of a good by an additional production or processing step. In this definition, service, retail, and wholesale are considered as income-generating activities, but not as value-adding.	
Discussion	*Rationale*: value adding has particular importance for regional rural development. Rural areas typically suffer from low levels of productive activities. Local products (which are mainly agricultural) tend to be exported as raw materials, whereas manufactured goods tend to be imported. An increase in the number and proportion of productive and food processing activities carried out within West Nile should lead to higher regional income. This would arise from two sources: firstly, by substituting products which would otherwise be imported, and thereby reducing outflows of money from the region; and secondly, by encouraging the emergence of new processing and producing businesses, thereby generating inflows of money into the region when these products are sold outside the area. *Limitations*: the classification of business activities is basic and does not contain precise details on business types and selling activities. The increase in the absolute number of businesses, as a more direct reflection of increased productive activities at the Impact level, is not included in the indicator, due to the difficulties in obtaining this information. However, when evaluating the programme it will be possible to obtain information on the total increase in registered companies in all six districts, and this can be used for interpretation.	
Source	Field survey: businesses	
Indicator calculation	data_base.xlsx and indicator I2.2.xlsx	
Data elements and variable codes	Proportion of different lines of businesses of businesses	IE13, IE14

Data presentation for I2.2

Chart 55, I2.2: Businesses and their different lines of businesses in not electrified TCs

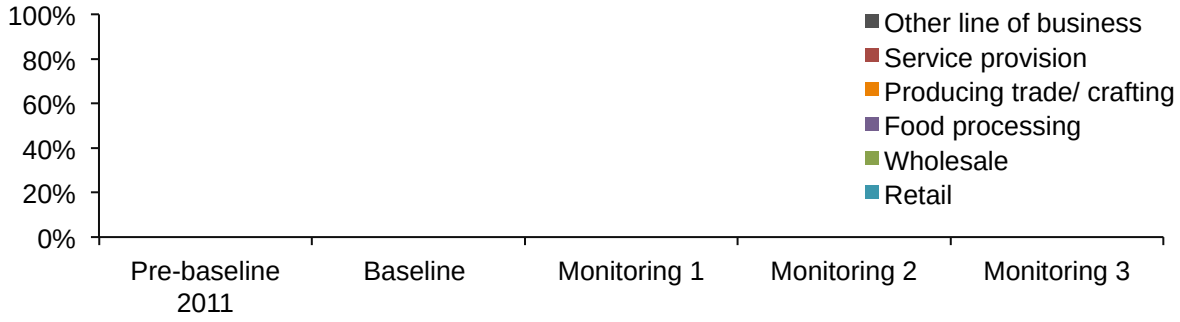


Chart 56, I2.2: Businesses and their different lines of businesses in electrified TCs

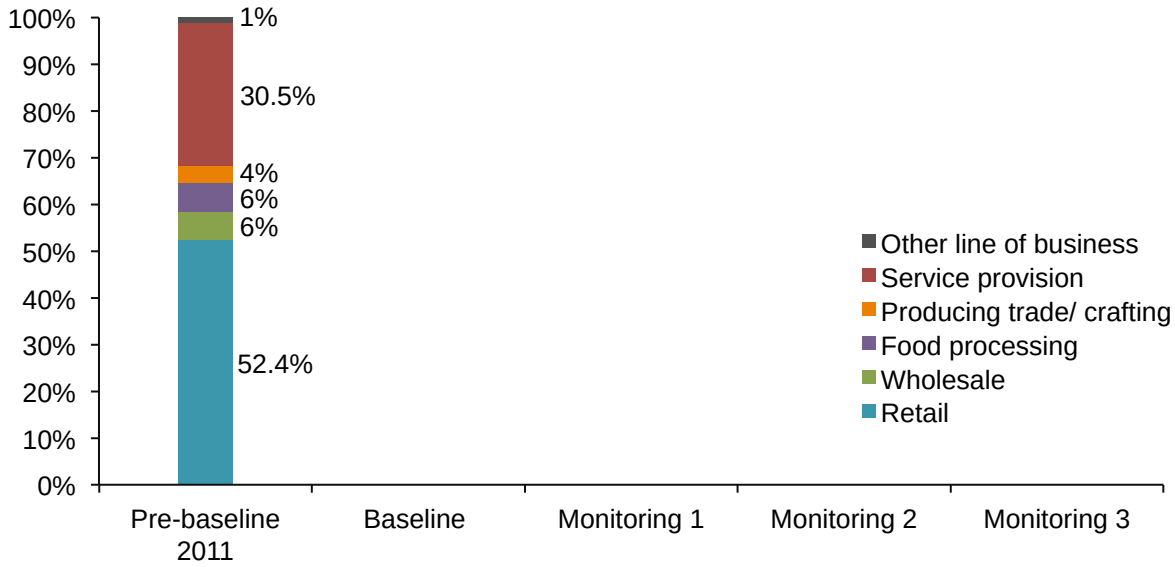
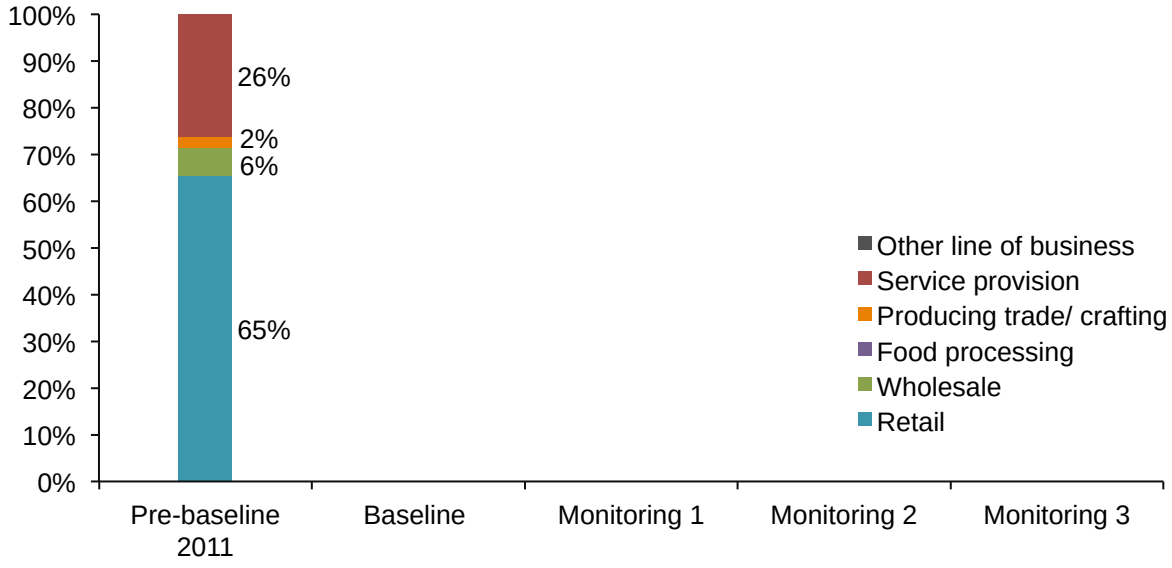


Chart 57, I2.2: Businesses and their different lines of businesses in towns



Indicator sheet I2.3

Result I2: Increased productive and income-generating activities		
Indicator	(I2.3) In electrified areas, the share of households with income-generating activities in general and the lines of businesses with local value adding have increased compared to business-as-usual	
Definitions	*Household with income generating activities:* small-scale business activities taking place on household premises, for which no permanent extra space is rented	
Discussion	*Rationale*: business activities at a household level reflect regional income-generating activities (see I2.2). The relevant information is collected during the field survey and obtained by questioning households directly. *Limitations*: imprecise definition of micro businesses. Emerging business activities do not necessarily depend on, or relate to, electricity.	
Source	Field survey: households	
Indicator calculation	indicator I2.3.xlsx	
Data elements and variable codes	Proportion of households with business activities	IE01
	Proportion of different lines of businesses of and proportion of business activities with productive and food processing business activities	IE02, IE03

Data presentation for I2.3

Chart 58, I2.3: Proportion of households with microbusinesses

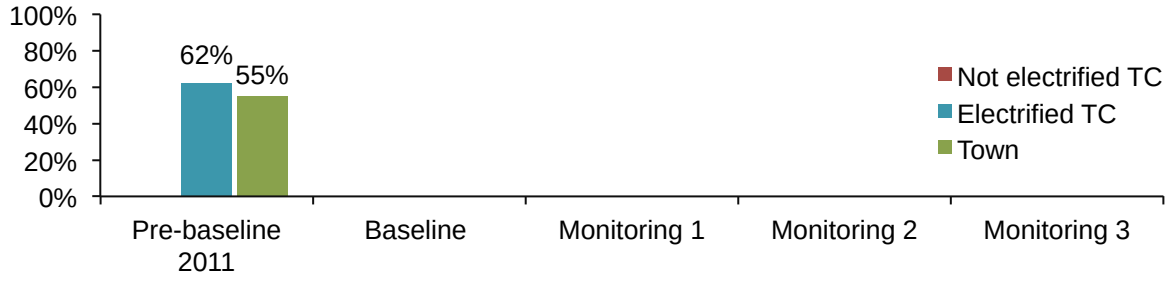


Chart 59, I2.3: Households with microbusinesses and their different lines of businesses in not electrified TCs

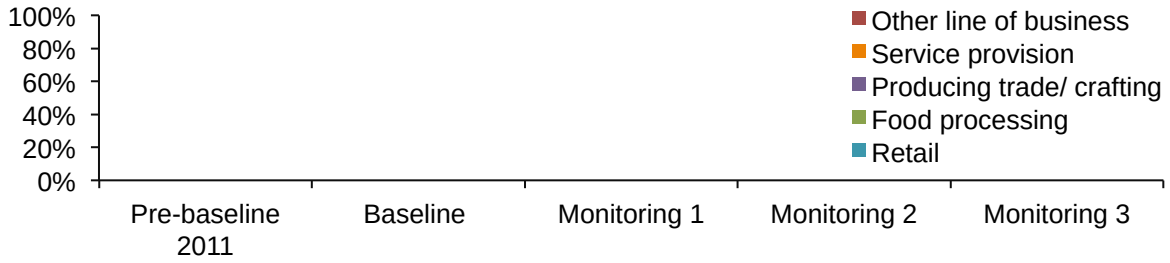


Chart 60, I2.3: Households with microbusinesses and their different lines of businesses in electrified TCs

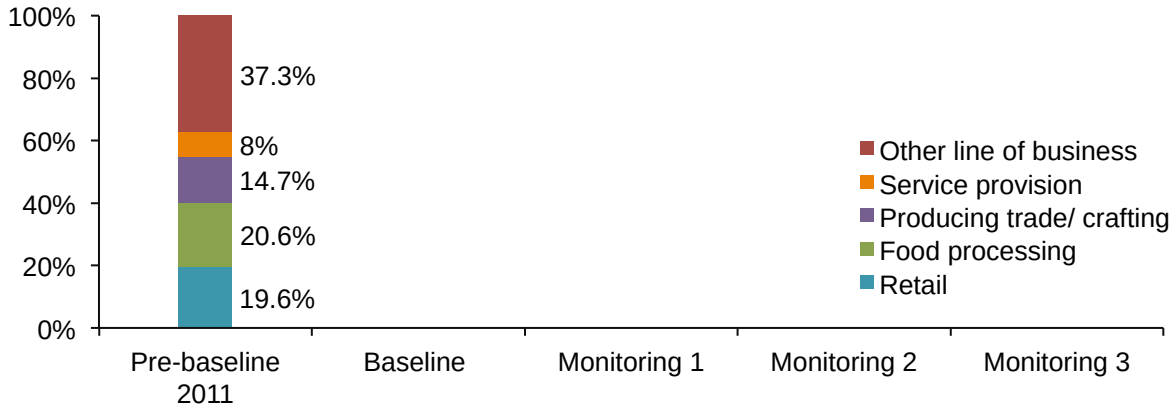
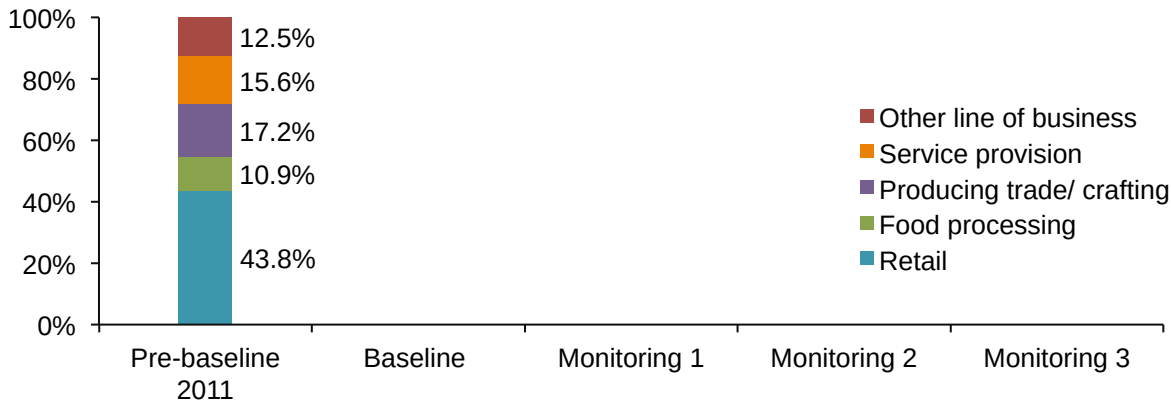


Chart 61, I2.3: Households with microbusinesses and their different lines of businesses in towns



Indicator sheet I3.1

Result I3: Contribution to improved education, healthcare, and water supply		
Indicator	(I3.1) In electrified areas, the proportion of secondary schools providing electricity-dependent educational services has increased compared to business-as-usual	
Definitions	*Electricity-dependent educational services:* refers to educational methods that need electricity, such as classes using computers, internet classes, and classes with natural science experiments which require electricity	
Discussion	*Rationale*: it is assumed that a connection to the grid opens a broad range of options for additional educational methods, which, taken overall, reflects an improved education. In addition, pupils at electrified boarding schools benefit from extended learning time for reading and homework when electric lighting is provided. *Limitations*: this indicator neglects the importance of other contributing factors, such as the existence, qualification and motivation of the teaching staff. Furthermore, no information is provided on the quality of the respective educational service.	
Source	Field survey: schools	
Indicator calculation	indicator I3.1.xlsx	
Data elements and variable codes	Proportion of secondary schools providing computer classes using computers, internet classes, and natural science experiments requiring electricity	GI15, ED01, ED04, ED07
	Proportion of boarding schools that provide lighting for assignments at night	GI04, ED10

Data presentation for I3.1

Chart 62, I3.1: Proportion of secondary schools providing computer classes

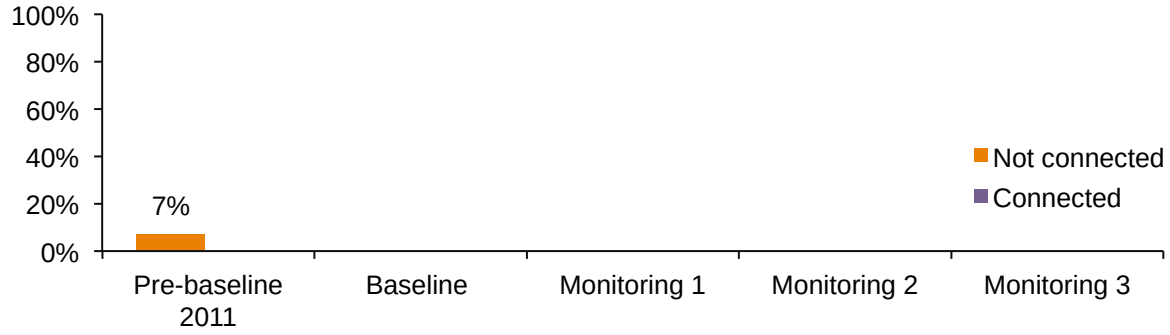


Chart 63, I3.1: Proportion of secondary schools providing internet classes

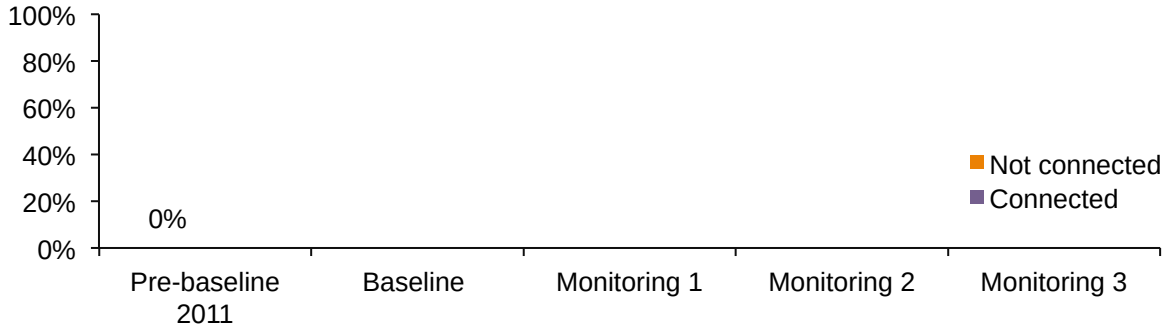


Chart 64, I3.1: Proportion of secondary schools providing natural science classes using electricity

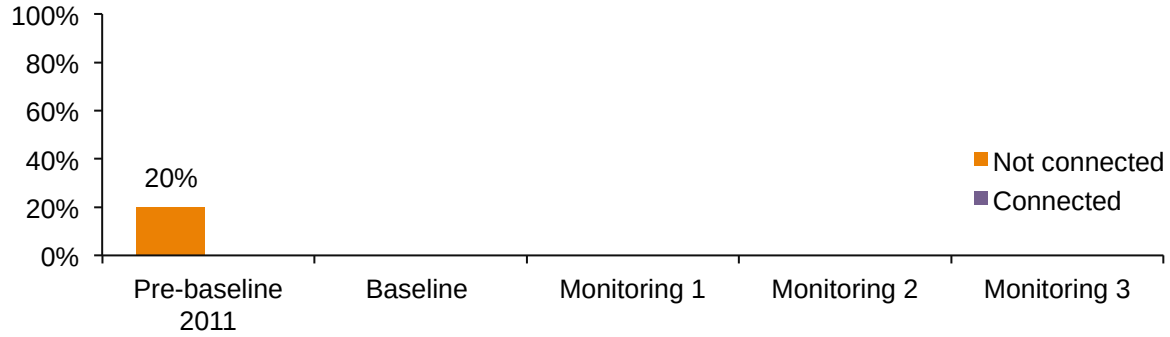
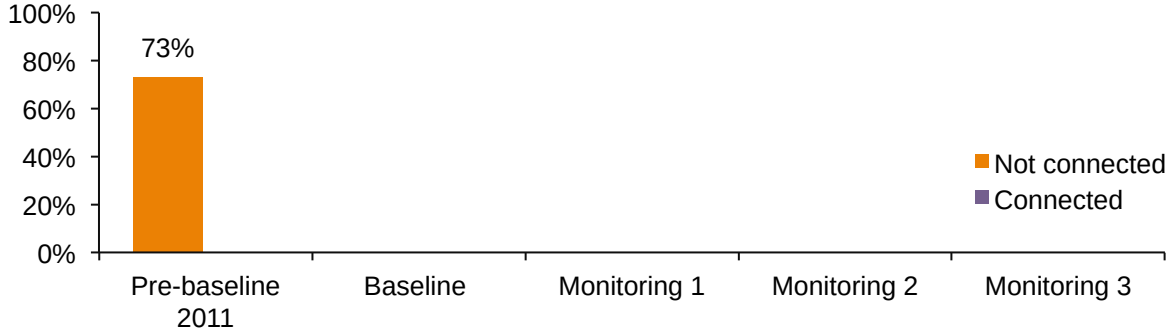


Chart 65, I3.1: Proportion of secondary schools offering lighting at night



Indicator sheet I3.2

Result I3: Contribution to improved education, healthcare, and water supply		
Indicator	(I3.2) In electrified areas, both (a) the proportion of health centres (level III and above) that offer key electricity-dependent health services, and (b) the proportion of such health centres that are able to provide such services whenever they are needed, has increased compared to business-as-usual	
Definitions	*Electricity-dependent health services:* refers to surgical procedures, vaccination, blood transfusion, X-ray, ultrasound diagnosis, adequate artificial lighting for obstetrics (childbirth), and 24hr emergency response	
Discussion	*Rationale*: electricity-dependent health services such as those named above are of key importance, and are considered essential for improving healthcare. The addition of “whenever they are needed” reflects the importance of the time dimension regarding the availability of such health services. *Limitations*: the indicator does neglect other limiting factors, such as adequate numbers of well-qualified health staff.	
Source	Field survey: health centres	
Indicator calculation	indicator I3.2.xlsx	
Data elements and variable codes	Proportion of health centres providing: surgical procedures, vaccinations, blood transfusions, X-rays, ultrasound diagnosis, obstetrics under artificial lighting, and 24hr emergency response	GI02, HS01, HS05, HS09, HS13, HS17, HS21, HS25
	Proportion of health centres where key electricity-dependent health services are always available whenever they are needed	GI02, HS02, HS06, HS10, HS14, HS18, HS22, HS26.

Data presentation for I3.2

Chart 66, I3.2: Proportion of health centres providing vaccinations, and share of health centres where this service is always available

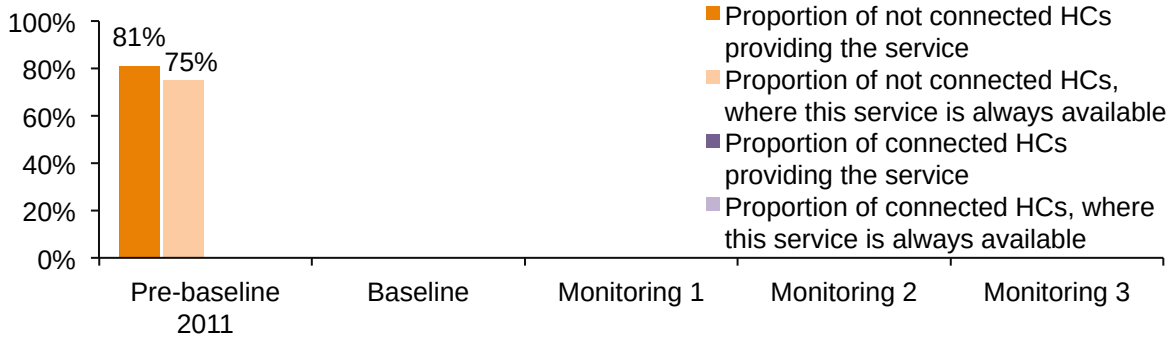


Chart 67, I3.2: Proportion of health centres, where it is possible to give birth under sufficient lighting, and share of health centres where this service is always available

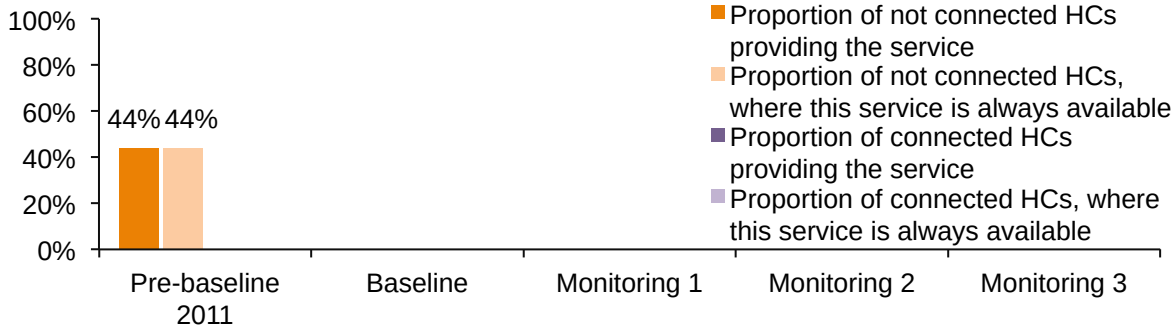


Chart 68, I3.2: Proportion of health centres that provide blood transfusion service, and share of health centres where this service is always available

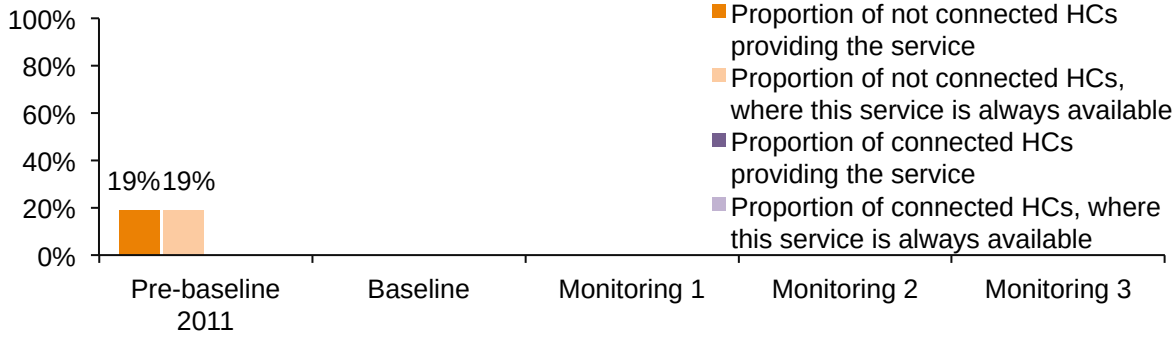


Chart 69, I3.2: Proportion of health centres that offer ultrasound diagnosis, and share of health centres where this health service is always available

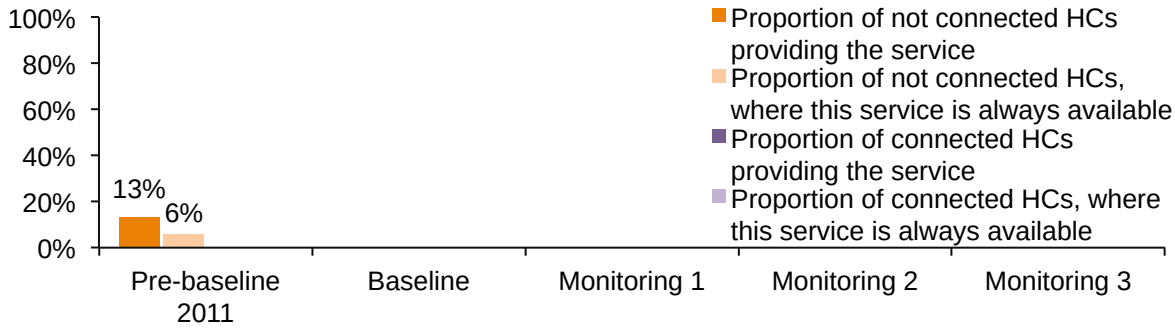


Chart 70, I3.2: Proportion of health centres that conduct surgeries, and share of health centres where this health service is always available

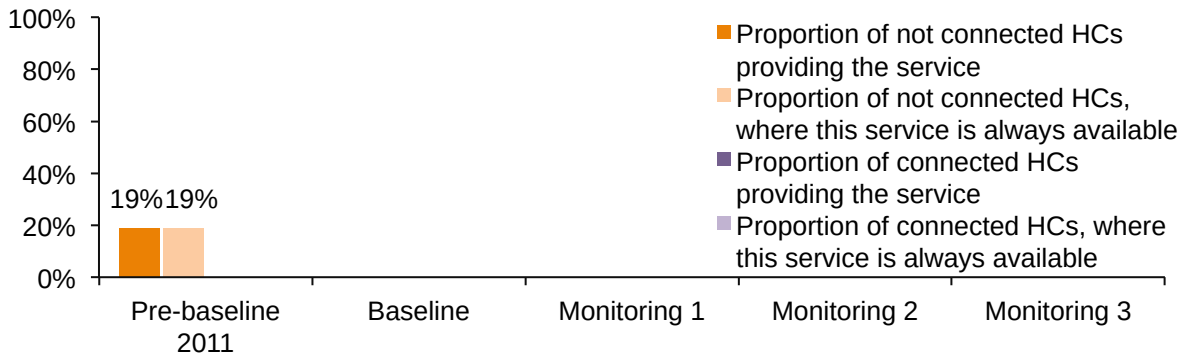


Chart 71, I3.2: Proportion of health centres that provide X-ray service, and share of health centres where this service is always available

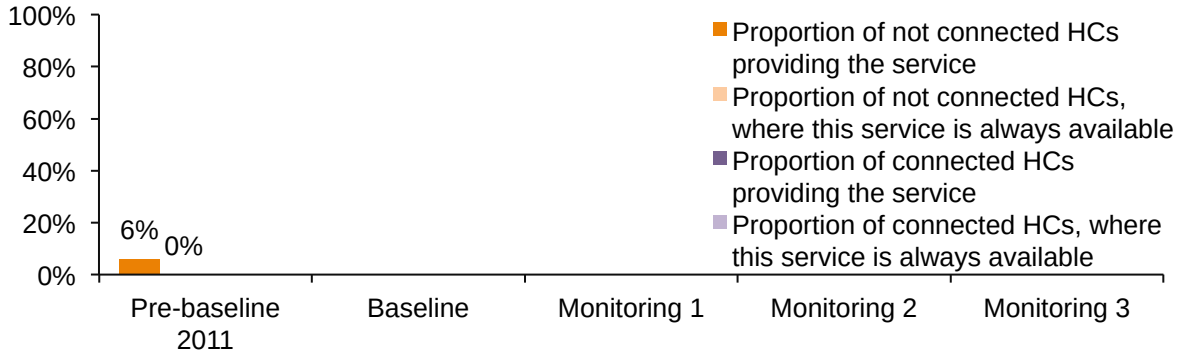
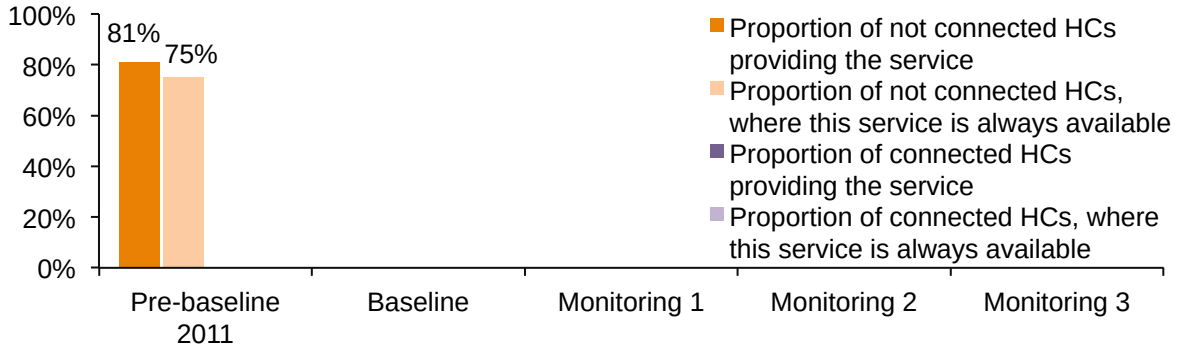


Chart 72, I3.2: Proportion of health centres that provide 24h emergency response service, and share of health centres where this health service is always available



Indicator sheet I3.3

Result I3: Contribution to improved education, healthcare, and water supply		
Indicator	(I3.3) The average number of customers of central water providers and the reliability of water supply in electrified areas has increased compared to business-as-usual	
Discussion	*Rationale*: central water supply improves the availability of safe water to the population, and also enables an increased number of people to be supplied. Moreover, grid electricity permits more dependable water pump operations, as electricity is cheaper compared to using other energy sources. An approximation of reliability is established by counting the number of days per year that water pumps are out of operation. This information is obtained by direct enquires with local water suppliers.	
Source	Field survey: water supplier	
Indicator calculation	indicator I3.3.xlsx	
Data elements and variable codes	Average number of customers from central water suppliers	WS11, WS13
	Average number of days per year when pumps are out of operation	WS13, WS14

Data presentation for I3.3

Chart 73, I3.3: Average number of customers of water suppliers

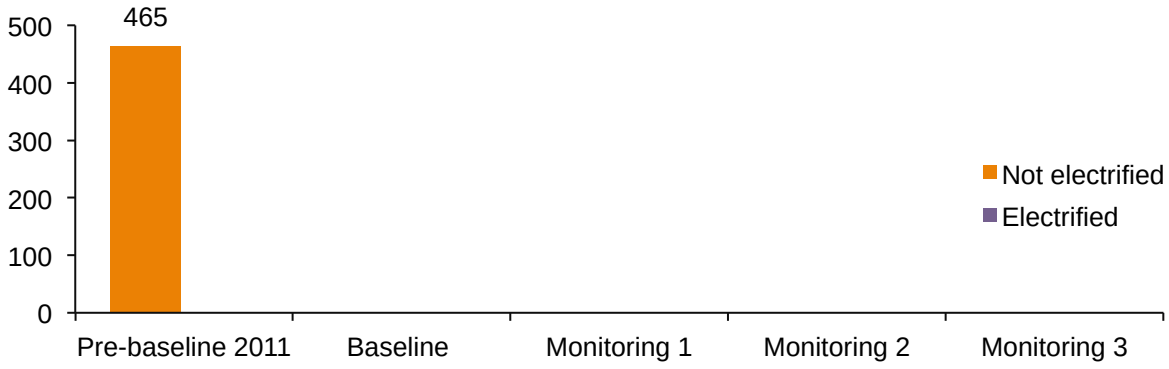
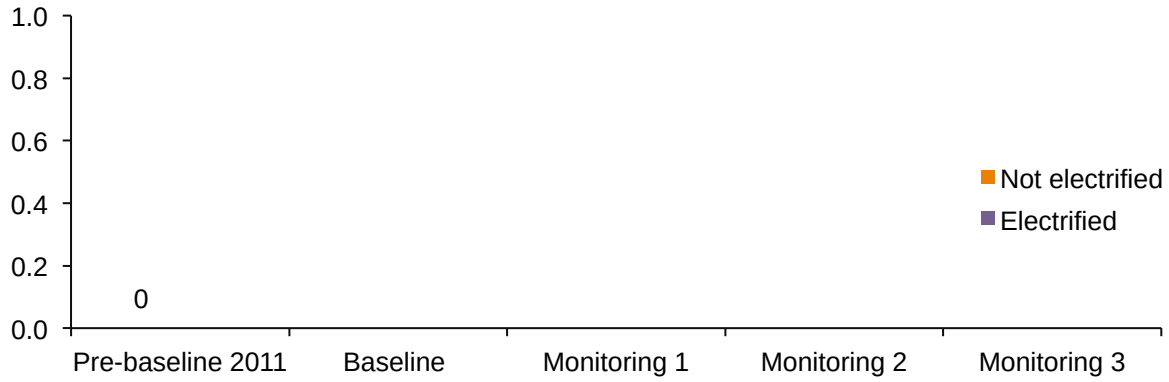


Chart 74, I3.3: Average number of days of non-operational pumps per year



2.5 Indicator sheets – Risks

This chapter provides an overview on the status of indicators which capture potential risks to the programme's success. These risks impinge on the results for schools and health centres at the Impact level. In contrast to the other indicators, the Risk indicators only present the situation for the electrified schools and health centres, and hence they do not follow a specific results attribution methodology. However, a brief discussion as well as information on data source, indicator calculation, data elements, and variable codes is presented below.

Indicator sheet R1.1

Risk R1: Staff and budget constraints for health centres and schools		
Indicator	(R1.1) The proportion of connected health centres quoting budget constraints or the non-availability of qualified staff as the main bottlenecks which prevent the delivery of some key health services remains high	
Discussion	*Rationale*: generally, the risk is only considered for connected health centres. The lack of qualified staff and/or budget constraints could severely hamper positive developments arising from the use of grid electricity. The relevant information is collected from health centres during the field survey. They are asked for the reasons for not offering certain health services. *Limitation*: the indicators are based on stated opinions instead of revealed numbers. Hence the information can be biased.	
Source	Field survey: health centres, schools	
Indicator calculation	indicator_R1.xlsx	
Data elements and variable codes	Proportion of health centres quoting budget constraints as a major bottleneck for not offering some key health services	GI02, HS01, HS03, HS05, HS07, HS09, HS11, HS13, HS15, HS17, HS19, HS21, HS23, HS25, HS27
	Proportion of health centres quoting staff constraints as a major bottleneck for not offering some key health services	

Data presentation for R1.1

Table 11, R1.1: Reporting on the status of risk indicators

	Pre-base-line 2011	Baseline	M01	M02	M03
Vaccinations					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
Childbirth under artificial lighting					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
Blood transfusions					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
Surgical procedures					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
Ultrasound diagnosis					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
X-ray diagnosis					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
24hr emergency response					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				

Indicator sheet R1.2

Risk R1: Staff and budget constraints for health centres and schools		
Indicators	(R1.2) The proportion of connected schools, quoting budget constraints or the non-availability of qualified staff as the main bottleneck which prevent the delivery of some educational services remains high	
Discussion	*Rationale*: generally, the risk is only considered for connected schools. The lack of qualified staff and/or budget constraints could severely hamper positive developments arising from the use of grid electricity. The relevant information is collected during the field survey from schools. They are asked for the reasons for not offering certain services. *Limitation*: the indicators are based on stated opinions instead of revealed numbers. Hence the information can be biased.	
Source	Field survey: health centres, schools	
Indicator calculation	indicator_R1.xlsx	
Data elements and variable codes	Proportion of schools quoting budget constraints as the main bottleneck for not offering some educational services	GI15, ED01, ED02, ED04, ED05, ED07, ED08, ED10, ED11
	Proportion of schools quoting staff constraints as the main bottleneck for not offering some educational services	

Data presentation for R1.2

Table 12, R1.2: Reporting on the status of risk indicators

	Pre-baseline 2011	Baseline	M01	M02	M03
Practical computer classes					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
Internet classes					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
Natural science experiments that require electricity					
Proportion quoting budget constraints as the main bottleneck	N.A.				
Proportion quoting staff constraints as the main bottleneck	N.A.				
Lighting to work on assignments at night					
Proportion quoting budget constraints as the main bottleneck	N.A.				

3 Discussion and Recommendation

The results presented in the previous chapter refer to the pre-baseline data collection, which was implemented to test the M&E procedure and to identify opportunities for improvement. Therefore, in contrast with future reports, we will not interpret the pre-baseline data in this chapter, but provide general hints and directions for future reporting on M&E results.

The M&E results should be analysed and discussed on three different levels. First, the quality of data collection should be considered. Second, the scope of (and limitations in) the attribution of documented changes to the programme intervention should be discussed. Third, an interpretation should be offered on the situation portrayed, highlighting potential implications and making recommendations for operational and strategic adjustments to the programme.

3.1 Quality of data collection

Much of the data required to monitor programme results derives from the field survey. Hence, it is essential that interviews are conducted in a standardised fashion and that high quality standards are maintained throughout the interview process. Similar high standards must also be applied to the data entry and calculation routines. If any irregularities arise in the data, these must be investigated and possible solutions proposed. If future M&E activities reveal that certain questions are no longer applicable or, if some issues were repeatedly challenged during the interviews, we recommend the M&E consultant should discuss this also in the report.

All primary data is checked for plausibility during data entry. The same check must be repeated for calculated values. If any indicator shows an unexpected result, then the base data needs to be checked for outliers. A rational and traceable decision must be taken on whether to exclude certain interviews in their entirety, or just disregard specific values.[26]

WENRECo data must also be tested for plausibility and cross-checked where possible. Any irregularities should be investigated immediately with WENRECo management.

Alterations to the results chain, its hypotheses or its indicators are not advisable under any circumstances for two reasons. Firstly, the system is very complex, and the

26 During the pre-baseline survey, apart from some implausible outliers, which were deleted from the data set, the data met the standard required. However, both data quality and data cleaning could have been more efficient if the training for both enumerators and data entry staff had been more stringent. Hence, we recommend thorough and extensive training for both groups to ensure in-depth understanding of the questionnaire.

whole M&E framework would need to be adjusted accordingly. Secondly, the baseline and monitoring data collected would no longer be comparable. However, it is important to monitor how appropriate the system remains to the situation in West Nile, and to provide feedback to the stakeholders with advice on possible survey improvements.

3.2 Scope and limitations of results attribution

The comparison of the mean values for the different units of analysis allows conclusions on results attribution to be drawn. The attribution level depends on the approach adopted for the respective unit of analysis and survey area. Net attribution is possible for households and businesses in trading centres as well as schools and health centres (through the double-difference approach), while only gross attribution is possible for households and businesses in towns (under the simple before-after approach).

The treatment group consists of connected and not-connected individuals. Hence, the difference in the mean values between the treatment and non treatment groups may be less if the comparison had been based on connected and not-connected individuals. However, mean values embrace the multidimensional facets of access for the beneficiaries, and so best reflect the concept of access to electricity-based services. Yet, the size of the sample and the sampling method still permit statistical testing of differences, and thereby allow statistically valid statements on group differences to be produced.[27]

Even though the double-difference method has been adopted, result hypotheses need to be developed rationally, on the basis of a cause-and-effect relationship. A clear attribution of net results depends on the validity of the underlying assumptions regarding the comparability of the treatment and comparison groups and their expected development dynamics. If any indicators indicate unexpected developments, or the result hypotheses are not verified, it is advisable to commission additional studies to investigate the causes, since other internal or external factors might have influenced the observed results.

Baseline results should be looked at somewhat differently. They act as a reference point for future assessments and are thus difficult to interpret per se. However, for the Impact level, the baseline data can be cross-checked with other socio-economic data collected by UBoS for the West Nile Region (especially with the 2012 census

27 As data from connected health centres and secondary schools originate from a total population survey, tests of significance or calculation of confidence intervals have to be applied carefully. It needs to be checked if conditions to apply certain methods and tests are fulfilled and sound interpretations can be made (Behnke 2007).

data, see Annex 2). Baseline data is also required by stakeholders so they can negotiate indicator targets.

3.3 Discussion of M&E results

The results of each M&E cycle can be assessed with regard to the degree of target achievement and the changes effected for the population in West Nile. The overall progress of the whole programme as well its different result levels can be assessed separately.

Output

The Output level indicators reflect whether the programme deliverables were provided in the quantity and quality and within the time planned. Dependent on their degree of completion, direct implications for activity-steering can be identified. Even though Outputs are essential prerequisites for the desired effects to evolve, they are already monitored by KfW and GIZ and are not interpreted in the context of this results-based monitoring and evaluation framework.

Use of Output

Indicators at the Use of Output level measure the efficiency, the reliability, and the spread of the grid supply that creates the foundation for access to electricity-based services. If one of the components is missing, achievement of the programme goal is put at risk. The data elements for the electricity supply indicators are reported by WENRECo every half-year and enable KfW to respond promptly, even between the two-year M&E cycles. Furthermore, the indicators reflecting the effects of the accompanying measures implemented by GIZ (awareness of the population regarding the potential and risks of electricity) are monitored with every two-year M&E cycle. The Use of Output indicators serve as a bridge to support the result chain and assisting in the possible attribution of effects at Outcome and Impact levels to the programme's Outputs.

Outcome

The Outcome level is at the centre of the M&E system, and the set of indicators on this level measures improvements in direct and indirect access to electricity-based services. Therefore, changes need to be looked at in detail, and interpretations should be made based on the whole indicator set, taking into account the dimensions of availability, affordability, and reliability. Use of Output indicators should also be included in assessing reliability, especially with regard to electricity supply.

Generally, the multidimensional concept of access to electricity-based services is reflected in the whole set of indicators. Hence, equal development should be observed for each indicator, and deviations should be reported and discussed. If the indicators reflect contradictory developments, e.g. the number of beneficiaries remains low while the number of electrical appliances is still increasing, possible explanations need to be identified.

As a first step, the suspect result can be cross-referenced against other indicators, e.g. in the case above, checked against the number of applications to WENRECo, the number of low-cost and prepaid connections, or the number of households or businesses that cannot pay their electricity bill. As a second step, the results could be discussed with stakeholders (WENRECo, local administration, target group) to seek clues for possible causes. Based on these steps, programme-steering activities should be recommended or, if required, further investigations in the form of separate studies might be proposed.

Impact

Impact level indicators, especially I2 and I3, measure anticipated indirect effects of the electrification programme. By definition, those changes are expected to become significant only after a considerable amount of time. For the M&E framework, the double-difference method is used, and only indicators which have a plausible impact hypothesis and can be practically measured have been selected. Measuring not only the connection to the grid but increasing access to electricity-based services at the Outcome level also supports the attribution of effects at the Impact level. For example, if it can be demonstrated that businesses have greater access to electricity, appliances and electricity-based services than before, the plausibility of the Impact hypothesis of intensification and diversification in economic activities gains support. However, the attribution of indirect results must still be discussed carefully, and if possible UBoS data should be used to cross-check the results measured.

Glossary & References

Glossary

Access: Describes the degree of availability, affordability and reliability of energy services demanded, such as illumination, heat, and transport, including the appliances needed to convert primary energy into the respective energy service. Energy services demanded vary among user types and according to their preferences; gaining access to energy services is not a sudden event, but a continuous process.

Alpha Error: Occurs if a test falsely rejects a true hypothesis.

Attribution problem: Describes the problem that it is not possible in most cases to ascribe a direct causal link between long-term changes observed and the outputs of a specific development intervention.

Baseline Survey: A baseline survey serves to ascertain the condition or situation, which exists prior to a development intervention. It serves as a reference point for later comparisons, in order to allow statements to be produced on the progress and success of the development intervention.

Beneficiaries: All institutions or individuals that have or share an electricity connection are considered as direct beneficiaries. Of these, only households, businesses, schools, and health centres are specifically reported by the M&E framework, while the rest are summarised within the number of commercial customers. For the considered beneficiary groups, only household members are calculated and reported as direct beneficiaries, to avoid double counting.

All people living in electrified areas can be considered as indirect beneficiaries, but with widely varying access to electricity-based services. Even households or businesses without an electricity connection benefit indirectly from improved educational, health and commercial services.

Cluster: The total population is divided into groups according to certain criteria (e.g. location, socio-economic conditions, or boundaries). A cluster is one of those groups.

Counterfactual: The counterfactual describes a situation or condition that hypothetically would appear without the development intervention (treatment).

Cross-sectional comparison: The cross-sectional comparison assesses the changes for the population by comparing treated and non-treated entities within that population at one specific point in time.

Customers: Are either individuals (e.g. household heads, owners of businesses), or institutions (e.g. health centres, schools, businesses) that hold a contract with WENRECo for electricity supply.

Data element: An indicator is composed of one or several data elements, each comprising specific information. If several data elements exist for one indicator, they can be used independently to describe a given situation, or can be used to calculate sample statistics.

Double-difference comparison: Collects information on treated and non-treated units of analysis before and after an intervention. The changes in Outcome variables in the comparison group are the counterfactual. The underlying trends for both the treatment and comparison group are assumed to be identical.

Electricity-based services: Energy services that use electricity as the final form of energy. In the case of the M&E framework for West Nile, electricity-based services are all services that depend on grid electricity provided by WENRECo.

Electrification corridor: The electrified corridor is the geographical area along the grid course where transformers are planned and a low-voltage connection could potentially be established (within a radius of 500 metres from the transformer). Localities that are close to the grid but lack a transformer are thus not considered as part of the electrification corridor.

Electrified area: See electrification corridor.

Energy service: An energy service comprises both the supply chain and the user demand. The supply chain is concerned with the conversion and distribution of final energy. The demand side considers the user's desire for certain energy services (such as lighting, heating, mechanical power, etc.) for which the final energy is used.

Evaluation: Evaluation is a systematic and objective assessment of a still ongoing or completed development intervention. It assesses the design, implementation, and results achieved. The aim is to determine the relevance and effectiveness, efficiency, impact, and sustainability of that intervention.

Factual: The factual describes the situation or condition that occurs due to a development intervention (treatment).

Household: A household is defined as all people living with the head of that household.

Household head: In West Nile, a household head is the household member who guides decision-making on major issues affecting the household.

Impact hypothesis: A hypothetical model of the cause-and-effect-relationship in a development intervention. It is used for planning, implementation, and assessment purposes.

Impact map: An impact map is based on a results chain, but enhances it with external factors (e.g. droughts, changes in national policies) that cannot be influenced directly, but have an influence on a project's or programme's success. Additional-

ly, a results map also considers unintentional side effects of a project/programme. The latter can be of a negative nature (e.g. increased prostitution) or a positive (e.g. improvements in drinking water supply).

Impact: Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended (OECD 2010: 24).

Indicator: A quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development actor (OECD 2010: 25)

Joint Programme Proposal: In a joint programme proposal to the Federal Ministry for Economic Cooperation and Development (BMZ) the KfW Entwicklungsbank, the GIZ and other German bilateral implementing organisations outline their complementary activities to tackle jointly the development challenge identified.

M&E framework: A M&E framework for a development intervention describes the results chain (including causes and effects) and the methodical approach; defines tools for data collection; proposes procedures for data analysis and interpretation; and defines roles and responsibilities within the M&E process. A M&E framework enables the performance of a development intervention to be assessed. Hence, it is important for programme management and informed decision-making by stakeholders.

Monitoring: A regular observation activity to systematically collect data, providing management and the main stakeholders of an ongoing development intervention with indications on progress and the achievement of objectives.

Multistage sampling: The total population is divided into a number of groups from which a sample is drawn. If necessary, this procedure can be repeated several times. Finally, only randomly selected entities from the groups are included in data collection.

Outcome: The likely or achieved short-term and medium-term effects of an intervention’s outputs (OECD 2010: 28).

Output: The products, capital goods and services which result from a development intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes (OECD 2010: 28).

Panel: In panel analysis, standardised observations are made on different variables for the same entities over multiple time periods.

Panel mortality: Entities of a panel are selected once and then repeatedly surveyed. Panel mortality describes the fact, that surveyed entities may not be available for

a survey at a later point (e.g. due to an individual's death or relocation, or due to an institution closing down).

Parent population: In statistics, the parent population comprises all entities from which a sample is surveyed and for which statistical inferences are to be drawn.

Pre-baseline: The SLE study team conducted a pre-baseline in West Nile in October 2011. The main purpose of the pre-baseline was to subject all data collection tools and processing procedures to in-depth testing. Practical experiences from the pre-baseline were formulated as suggestions for the M&E field survey and the complementary data survey. The data collected and processed during the pre-baseline was also used to cross-check data elements and illustrate indicator calculation.

Random walk: A procedure to randomly select the respondents in a field survey. The random walk is applied if no list exists from which the respondent can be selected. Therefore, the random walk determines from a starting point which route has to be followed in a random procedure.

Results: The Output, (Use of Output), Outcome, or Impact (intended or unintended, positive and/or negative) of a development intervention (OECD 2010: 33).

Results-based M&E: Regularly assesses the progress of a development intervention, and provides information for all results and for each level (Output, Use of Output, Outcome, and Impact).

Results chain: A results chain anticipates the causal sequence between a project's/programme's activities, its Outputs (products or deliverables), the Use of these Outputs, its Outcomes (direct effects) and eventually the more indirect, long-term Impacts.

Rural electrification: Describes the physical set-up of electricity generation and distribution infrastructure in rural areas. The main approaches for rural electrification are the extension of the national grid to rural areas, the set-up of medium-scale generation capability and island grids, and the dissemination of household size generation systems (mainly based on solar power).

Sample: A subset drawn from the parent population. The sample is selected according to the criteria of interest and in accordance with sampling procedures, in order to define the base of survey.

Sampling frame: The source material (e.g. household lists) from which a sample can randomly be drawn.

Simple before-after comparison: Collects information on treated units of analysis before and after the intervention. The baseline is used as counterfactual. To isolate the net effect, no underlying trend in the relevant Outcome variables is assumed to exist that would not also occur in the programme's absence.

Survey area: The survey area is the location in which the field survey is conducted.

Towns: Settlements in West Nile that have a town council status as district capitals or have a minimum of 20,000 inhabitants.

Trading centres: A trading centre is not an administrative unit in Uganda. It can best be understood as small rural settlement serving as the main site for local trade. Many trading centres are stretched across several villages (the smallest administrative units in Uganda) or even across several parishes.

Treatment group: The group of individuals or institutions that are directly treated, benefit from, or are influenced by the development intervention.

Unit of analysis: Is the major entity analysed in a study, and the subject of the statements produced in the study. In the M&E framework, they refer to some programme beneficiaries analysed at the Outcome and Impact level (households, businesses, secondary schools, and health centres of level III and above).

Use of Output: At the Use of Output level, the Outputs of a development intervention are used by the target group or intermediaries, and thereby contribute to the results at the Outcome and Impact levels.

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Annex

Contents

1 West Nile Fact Sheet

The West Nile sub-region is located in the north-westernmost part of Uganda. Uganda, a landlocked country in Eastern Africa stretching across the Equator, is home to approximately 33 million people (UBoS 2011: iv). Uganda is one of the poorest countries in the world; its Human Development Index score of 0.446 places the country in the 'low human development' category, and puts it on 161rd place in the UNDP country rankings (UNDP 2011). Uganda is structured into four regions - Central, Eastern, Northern, and Western - and nine sub-regions, of which West Nile is one within the Northern Region.

The sub-region of West Nile is located on the western side of the Albert Nile, part of the White Nile which has its source at Lake Victoria in the southeast of Uganda. It is a region mostly covered by savannah with a bi-modal rainfall pattern, the main wet months being August and September. The north of West Nile is significantly drier than the south. However, probably due to climate change, seasons have become increasingly irregular. While there is a small mountain range in the south of West Nile (rising to 1,700 m), most of the region is composed of low hills on a plateau which slopes from 1,200 m above mean sea level in the west down to 600 m towards the Nile in the east. To the north, West Nile is bordered by South Sudan and to the west it borders the Democratic Republic of the Congo.

Over the course of history, West Nile has been an area of great turmoil. In colonial times, as part of the Lado Enclave it passed from the Belgian Congo to Anglo-Egyptian Sudan, and finally to the Uganda Protectorate. In post-colonial times, West Nile became infamous as the birthplace of Idi Amin Dada, known for his brutal regime as President of Uganda from 1971 to 1979. During the 1980s and 1990s West Nile was the base for several rebel armies, such as the Uganda National Rescue Front and the West Nile Bank Front, and suffered from a civil war (see RLP 2004 for an in depth conflict analysis). This was further intensified through conflicts across its borders with southern Sudan and eastern Congo, and with the Lord's Resistance Army.

Since the region's pacification in 2002, West Nile has been recovering. Nonetheless, it remains one of the poorest regions of Uganda. Latest demographic projections suggest a population of almost 3 million people (UBoS 2011) in an area of approximately 16,000 km². The population is growing at a rate of more than three per cent every year. Almost 60 per cent of the population lives below the poverty line.

West Nile is an agricultural region with most of its population living in rural areas, many of whom depend on subsistence farming. Poor farming practices lead to land degradation; this is further worsened by deforestation, caused by a high demand for charcoal.

Much of the trade in West Nile takes place in the markets of the ‘trading centres’ – small agglomerations in rural areas with few permanents businesses – or in the bigger markets of towns such as Arua, Yumbe, and Nebbi. Still, West Nile (in particular its urban areas) is an economically dynamic region, which profits from its location close to the borders with Congo and Sudan as a regional cross-boarder trade hub.

Recently a major highway has been built which allows travel from Kampala (the capital of Uganda) to Arua (the region’s biggest town) in six to eight hours. Grid electricity is limited to a small generator-driven network with around 3,000 electricity customers, stretching from Wandi (a few kilometres North of Arua) to Nebbi and Paidha in the south of West Nile.

The population in West Nile can be roughly divided into five linguistic groups, which correspond with the main ethnic groups in the area. In the northeast around Moyo, most people speak Madi; more centrally, in the north around Yumbe, Aringa is predominantly spoken; and in the northwest around Koboko, many people speak Kakwa. The central part of West Nile around Arua is dominated by Lugbara, while in the south around Nebbi, Zombo, and Pakwach, people mainly speak Alur. While some of the languages (like Lugbara and Aringa) are very similar, some (such as Alur) are quite distinct from the rest.

From a religious perspective, most people in West Nile are either Muslims or Christians. There tend to be more Muslims in the north and in the town of Arua, while most of the central and southern parts of West Nile have a larger share of Christians.

West Nile is composed of eight districts: Adjumani, Arua, Koboko, Maracha, Moyo, Nebbi, Yumbe, and Zombo. Adjumani (located on the east of the Albert Nile) and Moyo, however, are often not considered part of the sub-region (and this is the case in the rural electrification investment programme in West Nile). The districts (administrative level V) are divided into counties (administrative level IV), sub-counties (administrative level III – ‘municipalities’ in urban areas), parishes (administrative level II – ‘wards’ in urban areas) and villages (administrative level I – ‘cells’ in urban areas). The latter form the smallest administrative unit in Uganda. At the moment, due to decentralisation, the number of administrative units in West Nile constantly changes as new districts, sub-counties, etc. are formed.

For most of these levels a local council (LC) is elected as the people’s political representatives, headed by the LC chairman. In addition, larger settlements without municipality status (in West Nile only Arua is a municipality) usually have a town council (headed by a town clerk), and the smaller of these have a town board.

Next to these elected bodies, there is a parallel structure of representatives from central government (e.g. the chief administrative officer on district level, and the sub-county chief at the sub-county level).

Even though decentralisation is progressing, for the energy sector it can be said that most decisions are still taken centrally, with little local government involvement. Table 13 gives a statistical overview of the region and its districts.

Table 13: Statistical overview of West Nile (Source: UBoS 2011)

District	Population	Area (km^2)	Population density (people per km^2)	People living below poverty line (%)	Number of Counties	Number of Sub-counties	Number of Parishes	Number of Villages
Adjumani	353,200	3087	114	68.2	1	6	35	176
Arua	751,700	4274	176	52.6	5	27	162	1335
Koboko	222,900	821	271	61.2	1	7	47	389
Maracha	193,200	381	507	54.1	1	13	39	n.a.
Moyo	382,400	1891	202	62.2	2	8	39	223
Nebbi	337,400	2917	116	54.5	3	19	87	1302
Yumbe	504,500	2403	210	62.9	1	8	42	322
Zombo	214,200	*	*	52.9	*	*	*	*
Total	**2,959,500**	**15,774**	**188**	**58,4**	**14**	**88**	**451**	**> 3747**
Total II**	**2,223,900**	**10,796**	**206**	**56,2**	**11**	**75**	**377**	**> 3348**

* As Zombo has only recently be separated from Nebbi district, some statistical data is not yet available for Zombo, and is still included in the numbers for Nebbi.

** The programme region excluding the districts Adjumani and Moyo.

2 Availability of Socio-Economic Data for West Nile

Socio-economic data for West Nile is collected by the local district administrations as well as in national surveys. Three different types of data sources can be distinguished:

- UBoS (census and national and regional surveys);
- district administrations;
- other ministries and national institutions.

UBoS – The Uganda population and housing census

The census is carried out by UBoS every ten years, the last time being in 2002, and it will be conducted again in 2012. The census focuses on four main areas: (1) population size and composition, (2) population characteristics (covering religion, ethnicity, education, and economic activities, but gathering little information on disability and health), (3) household and housing characteristics, and (4) population trends. The census represents the most comprehensive data source; it is estimated that the 2002 census covered over 95 per cent of all households. According to UBoS (personal communication), disaggregated data at the district level from the 2012 Census will be available by December 2013.

UBoS – National and regional surveys

Between censuses, the main source of statistical data is the Ugandan National Household Survey (UNHS). UBoS implements this survey every few years, with the last one being in 2009/2010 (and, before that, in 2005/2006). For the last survey, 712 enumeration areas were defined across all 80 districts, with a total of 6,800 households being interviewed. The survey consists of six modules: (1) socio-economic data, (2) labour force, (3) informal sector, (4) community survey, (5) prices, and (6) qualitative household data. However, the results are aggregated at the level of the four main regions only (Central, Eastern, Northern, and Western). UBoS cannot disaggregate the data for single districts, but this can be done for the sub-region of West Nile (personal communication). To obtain such data an official request must be made to UBoS, specifying the data elements required.

Every five years, UBoS (with support from USAID) also carries out the Ugandan Demographic and Health Survey (UDHS), as part of the worldwide Demographic and Health Surveys (DHS) project. The 2011 UDHS is currently in progress, while the last UDHS was conducted in 2006. This covered 368 enumeration areas in most of the 80 districts, and entailed interviews with a total of 9,864 households. The UDHS provides detailed information on all aspects of health, and also covers all the health-

related MDG indicators. This data is disaggregated for the nine sub-regions (see Annex 1), and consequently provides data for West Nile, including the districts of Moyo and Adjumani. Unfortunately, UBoS cannot provide disaggregated data at district level.

In 2004 UBoS conducted the Northern Uganda Baseline Survey (NUS), collecting socio-economic data from 4,787 household interviews in 18 districts. Results are presented for five regional areas, of which one is West Nile (including Moyo and Adjumani). Some socio-economic data is also disaggregated and presented for districts. The NUS was specifically implemented by UBoS on behalf of the Office of the Prime Minister, and unfortunately it is unclear if the survey will be repeated in the near future.

UBoS also provides a national annual Statistical Abstract that presents updated and projected socio-economic data based on the census, surveys, and district data. The comprehensive statistical annex of the abstract also provides, to a limited extent, disaggregated data for all districts.

District administrations

Each year every district is supposed to provide a Higher Local Government Statistical Abstract covering administrative and socio-economic data from the districts. However, the preparation and quality of these abstracts depends largely on the resources of the district administrations (in terms of staff and budgets) and, especially for newer districts, the abstracts are not produced in a timely fashion, and they tend to lack accuracy.

The data provided consists of a mixture of data from the last census in 2002 (which is to some extent out-of-date) and new data collected and updated by the district itself. Of the six districts in West Nile that are covered by the electrification programme, only Arua (2010/2011) and Koboko (2009) have already prepared statistical abstracts.

Each district can also provide data on existing educational and health facilities. The collection of data from the districts is not easy, as access to email and the internet in most districts of West Nile is either non-existent or unreliable, and therefore each facility has to be visited individually. When data for the pre-baseline was collected it was often not possible to access the data files due to blackouts or equipment failures, while hard copies were outdated or not available. As this information is also reported on a regular basis to the Ministry of Health and the Ministry of Education and Sports, data collected for all six districts can be obtained more easily by directly approaching the relevant Ministry in Kampala.

Other ministries and national institutions

The Ugandan National Examination Board (UNEB) can provide upon request the number of completed grades and the average grades for each year and for each school in Uganda.

The Ugandan Revenue Authority (URA) has three offices in West Nile in Nebbi (also responsible for Zombo), Arua (also responsible for Maracha and Yumbe), and in Koboko. However, the regional office in Arua can provide upon request the number of registered companies for all six districts, but unfortunately not disaggregated for each district.

The Ministry of Education and Sports can provide lists of all primary, secondary, and public vocational schools and universities in West Nile. The Ministry also annually prepares the Uganda Education Statistical Abstract on the status of the Ugandan educational system.

The Ministry of Health can provide lists of all health centres in West Nile and prepares an annual statistical abstract on the status of the Ugandan health system, which is accessible from the Ministry's website.

3 Discussion of Beneficiary Calculation

Households

The number of connected households is provided by WENRECo. Both the average household size and the average number of households that share a connection is captured during the field survey. The calculation of the number of people covered by household connections is therefore comparatively straightforward. However, a cross-check of the pre-baseline data (average household size 7.9) and UBoS data (average household size 5.2) reveals a substantial difference. This difference might be caused by different definitions of a household. In West Nile, we counted all the persons who are permanently living with the head of a family as a household. Even though the real numbers are probably higher, the UBoS average of 5.2 people per household has been used, in order to be conservative in our estimation of household beneficiaries.

Businesses

The number of connected businesses is provided by WENRECo. The average number of businesses that share a connection is also captured during the field survey. The number of businesses covered by business connections is calculated on the basis of this data. For businesses, employees are not counted as beneficiaries because some employees might have direct access to electricity (e.g. an assistant in a copy shop which is connected to the grid) while others (the shop's night guard) can only benefit very indirectly from the business' improved access to electricity.

Schools

The number of connected educational institutions is provided by WENRECo. To calculate the number of persons directly covered by schools, the number of full time pupils and students has to be estimated. While for primary and secondary schools these numbers can be collected, it is difficult to specify the number of persons that use universities and vocational schools on a day-to-day basis. Therefore, the number of beneficiaries of educational institutions is not calculated in the M&E Framework.

Health centres

The number of connected health centres is provided by WENRECo. The calculation of people covered by health centres poses a specific challenge, as it is difficult to define the beneficiaries of a health centre. The definition could be confined just to in-patients, or it could include regular out-patients as well, or it could even be extended to include every person in the area covered by the health centre in question. Therefore, only the number of connected health centres is provided within the M&E framework.

4 Impact Map

The impact map (Figure 9) illustrates the core results chain and enhances it by risks, possible long-term effects, positive, and negative side effects (see I–3.2). The big pale boxes signify the result levels Output (bottom), Use of Output, Outcome, and Impact (top). The smaller boxes with round edges (in purple, blue, green, and orange) display the core, planned programme results. The small boxes with sharp edges signify the risks to the achievement of the results (red), possible long term-effects (brown), positive side effects (yellow), and negative side effects (grey). The arrows indicate causal links and influences between the different elements of the impact map.

While all of the elements of the core results chain (as presented in I–4.2) are part of the regular monitoring, all other aspects of the impact map are proposed for the qualitative evaluation of the programme (see I–6.2).

In fact, this impact map is already condensed. We have identified many other possible risks and side effects (e.g. reduced noise pollution, negligence of consumptive energy use promotion, lacking availability of microcredits, cultural reservations against electricity use). However, we learned that these are of low relevance in the context of West Nile and the rural electrification programme. Thus they do not need to be part of the M&E framework.

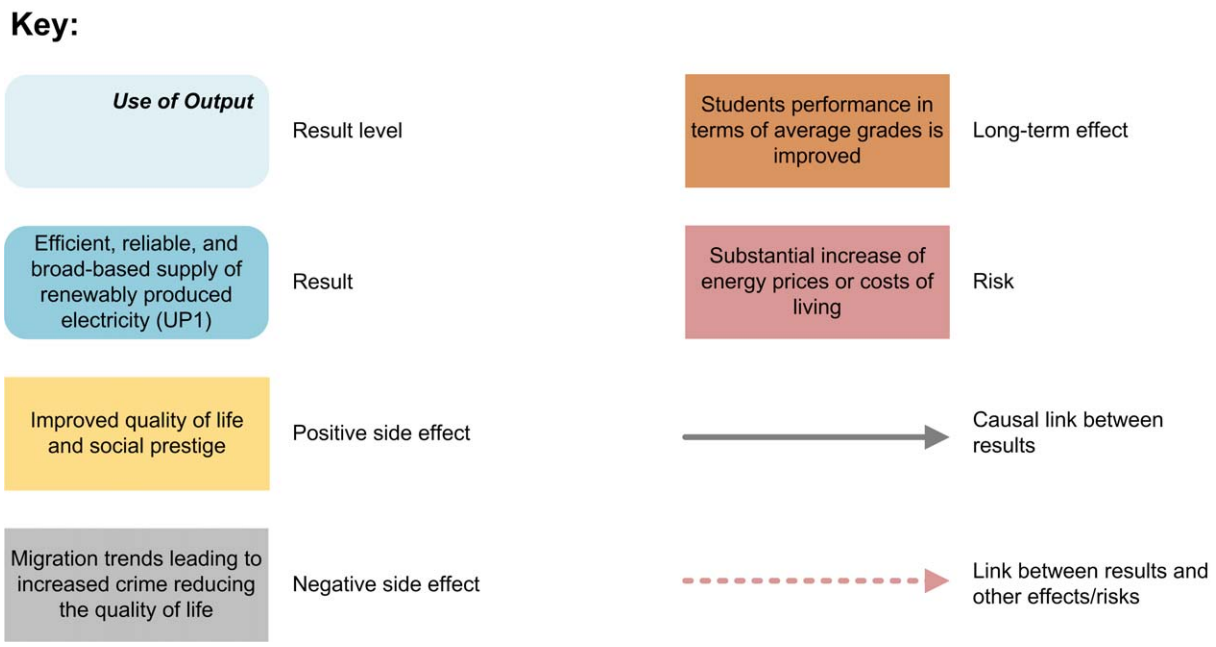
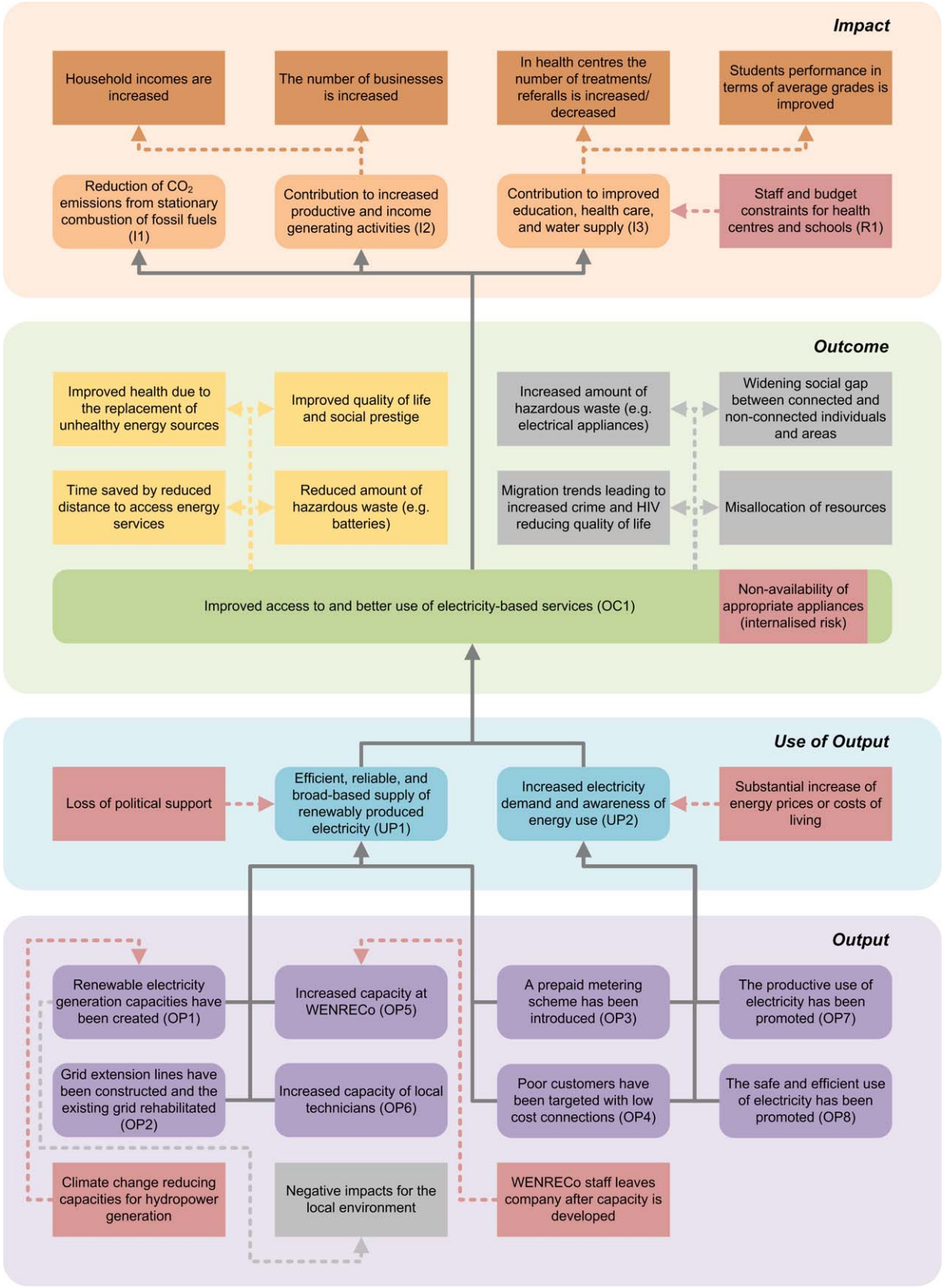


Figure 9: Impact map for the rural electrification programme in West Nile



5 Calculation of Emission Factors

The 2006 IPCC Guidelines for National Greenhouse Gas Inventories are used to calculate carbon dioxide emissions (IPCC 2006). The guideline proposes three different approaches for calculating emissions, depending on the availability of national data for the underlying emission models. Even though Uganda carried out a national greenhouse gas (GHG) inventory in 1994 (UNEP 1996), the data is rather limited and outdated, and is not very representative of the specific situation in West Nile. Therefore only the simplified 'tier 1' approach is used, calculating fuel-based emissions based on the quantities of fuel combusted and average emission factors.

Only fossil fuels are considered in the emissions calculation. For biomass, no data is available on the proportion which is produced sustainably (with no GHG footprint) and the proportion produced unsustainably, for which GHG emissions would need to be calculated. Furthermore, such a calculation would require detailed data on the energy value and carbon content of the biomass used, and also on possible emissions caused by changes in land use; such data is not available for West Nile.

Of the GHG emissions, only carbon dioxide is considered, because data on combustion technologies and operating conditions has not been systematically collected for West Nile and the "emission factors for methane and nitrous oxide depend on the combustion technology and operating conditions and vary significantly, both between individual combustion installations and over time. Due to this variability, use of averaged emission factors for these gases, that must account for a large variability in technological conditions, will introduce relatively large uncertainties" (IPCC 2006: Volume 2, 1.6).

Attention has been focussed on stationary combustion, targeting the six fossil fuels that are mainly used in West Nileheavy fuel oil, diesel, gasoline (petrol), kerosene, liquefied petroleum gas (LPG), and paraffin wax. IPCC (2006) defines these fuels on the basis of IEA definitions (according to IEA 2005). Under this set of definitions no distinction is made between heavy fuel oil and diesel. Table 14 shows the net calorific values and default emission factors for stationary combustion of the five fuel types presented. These are the same across all relevant sectors, including the energy industry, manufacturing and construction, commercial and institutional, as well as residential, agriculture, forestry, and fishing.

Table 14: Net calorific values and default emission factors

Fuel Type	Definition	Net calorific value[a]	Den-sity[b]	Default emission factor		
		(MJ/kg)	(kg/m^3)	(kg CO_2 /GJ)[c]	(kg CO_2 /kg)	(kg CO_2/l)
Gas/ Diesel Oil	Gas/diesel oil distils between 180ºC and 540ºC. Several grades are available dependent on application: diesel oil for diesel compression ignition (cars, trucks, marine, etc.), light heating oil for industrial and commercial uses, and heavy fuel oil.	43.0	843.9	74.1	3.186	2.689
Motor Gasoline (Petrol)	Motor gasoline (petrol) is distilled between 35ºC and 215ºC and is used as a fuel for land-based spark ignition engines. Motor gasoline may include additives, oxygenates, and octane enhancers.	44.3	740.7	69.3	3.070	2.274
Other Kerosene	Kerosene comprises refined petroleum distillates, intermediate in volatility between gasoline and gas/diesel oil. It is a medium oil, distilling between 150ºC and 300ºC.	43.8	802.6	71.9	3.149	2.527
Liquefied Petroleum Gases (LPG)	LPG are the light hydrocarbons fraction of the paraffin series, comprising propane (C_3H_8) and butane (C_4H_{10}) or a combination of the two. They are normally liquefied under pressure for transportation and storage.	47.3	522.2[d]	63.1	2.985	1.559
Paraffin Waxes	Paraffin waxes are saturated aliphatic hydrocarbons (with the general formula C_nH_{2n+2}). They have a crystalline structure with n greater than 12 and are colourless and translucent, with a melting point above 45°C.	40.2	--	73.3	2.947	--

(a) Source: IPCC 2006: Volume 2, 1.12-1.19

(b) Source: IEA 2005: 181

(c) Source: IPCC 2006: Volume 2, 2.16-1.23

(d) Assumes a mixture of 70 per cent propane and 30 per cent butane by mass.

6 Household Questionnaire

Code *(not to be filled by the enumerator!)*	QNumber

1. Identification sheet

Enumerator ID *(fill in your ID)*	**Date of interview**	**No. of Interview** *(running interview number this day)*	**Starting time** *(in 24h format)*	**Ending time** *(in 24h format)*
IS01	IS02	IS03	IS04	IS05

Name of interviewee	IS06

District	IS07
Sub-county	IS08
Trading centre/Town	IS09

Is this trading centre/town area connected to the WENRECo grid?	IS10	Yes ☐ / No ☐

Filling in the questionnaire

1. Answers are to be filled into the white boxes
2. Never put more than one number, code, tick, etc. into a single box
3. Each and every white box needs to be filled in
4. If the question does not apply cross out the white box with an “X”, see example to the right
5. If you pose a question and the interviewee does not know the answer or refuses to answer fill in a “999”, see example to the right

Example if question does not apply:

XY01 ☒

Example if question is not answered or interviewee refuses the answer:

XY01 999

Conducting the interview

1. Use your own observations to verify information: reecho answers that do not seem reliable, probe
2. Create a positive atmosphere and ensure a conducive setting (minimal disturbances, no outsiders listening)
3. Be neutral throughout the interview and never suggest answers to the interviewee
4. Do not create expectations or suggest any promise of project benefits
5. Ensure confidential treatment of the information given
6. The interview guide has to be signed by the enumerator and interviewee, fingerprint is also possible

Introduction

- “Good morning/good afternoon, my name is […] *(give name and credentials).*
- I am working as enumerator for a survey on energy use and energy supply. The survey is carried out on behalf of KfW, the German Development Bank. For this, we interview a representative number of house-holds, health centers, schools, and businesses in West Nile.
- The results of the survey will serve as basis for decisions on future development programmes in the region. Therefore we heavily depend on exact, truthful, and comprehensive information. There is no good/bad or wrong/false answer. Of course, all information provided by you will be handled confidential.
- This interview should not take more than 30 minutes to complete.
- If you are willing, I would very much appreciate your participation in our survey!“

2. General information

How many boys, between 0 and 15 years old, belong to this household (live under the same head of family)? (*fill in the number*)	GI01
How many girls, between 0 and 15 years old belong to this household (live under the same head of family)? (*fill in the number*)	GI02
How many men older than 15 years belong to this household (live under the same head of family)? (*fill in the number*)	GI03
How many women older than 15 years belong to this household (live under the same head of family)? (*fill in the number*)	GI04
Altogether, how many persons belong to this household? *(fill in the number, be careful and cross check if the sum is correct)*	GI05

What is the sex of the head of family?	GI06 Male ☐ / Female ☐
What is the highest formal education attained by the head of family? *(use code below, for other put a "7" in the right box, and specify in the small box to the left of it)* *0 = No formal education* *1 = Primary school (P7)* *2 = O-level (S4) / Junior* *3 = A-level (S6)* *4 = Vocational school degree* *5 = Bachelor degree* *6 = Master degree* *7 = Other (specify)* GI08	GI07

Is your household connected to the WENRECo grid?		GI09 Yes ☐ / No ☐
If yes ... *(only ask households connected to WENRECo)*	**... does your household have its own meter?**	GI10 Yes ☐ / No ☐
	... how many neighbouring households are connected to your WENRECo electricity meter? *(fill in the number of households, if none, fill in "0")*	GI11
	... how many times did you get disconnected due to outstanding bills during the last 12 months? *(fill in the number of times, if none, fill in "0")*	GI12
If no … *(only ask households not connected to WENRECo)*	**... due to not being connected to the grid, do you feel excluded from social developments in your community?**	GI13 Yes ☐ / No ☐
	If you feel excluded, please specify in how far! *(just note the most important point and if deemed necessary, urge interviewee to keep it short!)*	
	GI14	

What is the type of roofing found on your household premises? *(use code below, for other put a "4" in the right box, and specify in the small box to the left of it, if several types can be found on the premises, select the roofing of the house where the head of family sleeps)* *1 = Thatched* *2 = Iron sheet* *3 = Tiles* *4 = Other (specify)* GI16	GI15

3. Income and expenditures

Is there any income generating activity taking place <u>on your household premises</u>? *(Only tick yes if income generation really takes place at home and not in a separate location!)*			IE01 Yes ☐ / No ☐
If yes... *(only ask households with income generating activities)*	**... what kind of income generating activity do you do?**	IE02	
	... of what category is this income generating activity? *(use code below, for other put a "6" in the right box, and specify in the small box to the left of it, if a combination of activities exists decide on one main type!)* *1 = Retail* *2 = Food processing* *3 = Producing trade/crafting* *4 = Service provision* *5 = Other (specify)* IE04		IE03
	... apart from light appliances, do you know of any electrical appliances that could increase your profits?		IE05 Yes ☐ / No ☐
	If you know any, please name the appliances! *(write down the appliance names)*		
	IE06		

What were the household's expenditures in the last month for each of the following categories? *(fill in the amount for each category, if nothing was spend for any of the categories, fill in a "0")*	**UGX per month**
Food and foodstuff	IE07
Water supply	IE08
Clothes	IE09
Transport	IE10
Energy (electricity and other energy source costs)	IE11
Housing (including rent and repairs)	IE12
Medical care/health	IE13
Education/school	IE14
Repayments of loans	IE15
Agricultural expenditures (e.g. seeds, fertilizer, rent, labour)	IE16
Purchases for income generating activities at your home (only for households where these are existing)	IE17
Other expenditures *(specify for what and also state amount)* IE19	IE18

How much money could your household put aside/save in the last month? *(if amount cannot be obtained for the last month ask for the last year and divide by 12, for no savings put "0")*	IE20 UGX
How many remittances did your household receive in the last month? *(if amount cannot be obtained for the last month ask for the last year and divide by 12, for no remittances put "0")*	IE21 UGX

4. Energy sources and fuels

Which energy sources are used in your household? *(read out the items on the list one by one)*	**Yes/No**	**If the energy source is used in the household...** *(ask these questions only for the energy sources used!)*				
		... what is the amount of each energy source used per month in your household? *(If amount cannot be specified on a monthly base probe! – e.g. ask for yearly amount and divide by 12)*			**... how much do you spend for each energy source used by your household per month?** *(write amount in UGX)*	
Diesel	EF01 ☐ / ☐	EF02 In total L	EF03 For transport L		EF04 In total	EF05 For transport
Petrol	EF06 ☐ / ☐	EF07 In total L	EF08 For transport L		EF09 In total	EF10 For transport
Kersene/Petroleum/ Paraffin	EF11 ☐ / ☐	EF12 L			EF13	
Candle	EF14 ☐ / ☐	EF15 pc.			EF16	
Gas (LPG) *(cyl. = cylinder)*	EF17 ☐ / ☐	EF18 6kg cyl.	EF19 12,5kg cyl.	EF20 38kg cyl.	EF21	
Dry-cell battery	EF22 ☐ / ☐	EF23 pc.			EF24	
WENRECo grid	EF25 ☐ / ☐	EF26 kWh/units			EF27	
Generator set owned by neighbour/local supplier	EF28 ☐ / ☐	EF29 kWh			EF30	
Solar system owned by neighbour/local supplier	EF31 ☐ / ☐	EF32 kWh			EF33	
Firewood	EF34 ☐ / ☐	EF35 bundles	or:	EF36 m^3	EF37	
Charcoal	EF38 ☐ / ☐	EF39 sacks	or:	EF40 baskets	EF41	
Animal dung	EF42 ☐ / ☐	EF43 buckets			EF44	
Crop residues	EF45 ☐ / ☐	EF46 bundles			EF47	
Other (please specify source) EF49	EF48 ☐ / ☐	EF50	EF51 *(specify unit)* _____		EF52	

5. Appliances

Which of the following electrical appliances do you have in your household that are used and operational? *(fill in the number for each appliance, if appliance not available put "0", count only those that are available on the household premises!)*

Appliance		Number	Appliance		Number
Lighting (all electrical appliances used to create light)					
Normal bulb		AP01	Solar Lamp		AP02
Energy saving bulb (incl. fluorescent tubes)		AP03	Battery torch/lamp		AP04
Other (specify)	AP05	AP06	Other (specify)	AP07	AP08
Other (specify)	AP09	AP10	Other (specify)	AP11	AP12
Heat (all electrical appliances used for cooking, heating water, etc.)					
Kettle (electric)		AP20	Stove (electric)		AP21
Iron (electric)		AP22	Oven (electric)		AP23
Toaster		AP24	Combined stove/oven (electric)		AP25
Hair dryer		AP26	Boiler (electric, for water)		AP27
Hair straightener		AP28	Microwave		AP29
Other (specify)	AP30	AP31	Other (specify)	AP32	AP33
Other (specify)	AP34	AP35	Other (specify)	AP36	AP37
Cooling (all electrical appliances used to cool foodstuff, drinks, rooms, etc.)					
Fridge		AP40	Freezer		AP41
Fridge with freezer		AP42	Air conditioning		AP43
Other (specify)	AP44	AP45	Other (specify)	AP46	AP47
Other (specify)	AP48	AP49	Other (specify)	AP50	AP51
Information, entertainment, communication, computer, and internet (all electrical appliances used for these purposes)					
Mobile phone		AP60	Video playback (DVD, VHS)		AP61
Landline		AP62	Personal computer (desktop)		AP63
Fax (machine)		AP64	Laptop computer (notebook)		AP65
Radio		AP66	Printer		AP67
TV		AP68	Copying machine		AP69
Other (specify)	AP70	AP71	Other (specify)	AP72	AP73
Other (specify)	AP74	AP75	Other (specify)	AP76	AP77
Mechanical power (all appliances with an electrical engine)					
Blender		AP80	Electrical screwdriver		AP81
Mixer		AP82	Drill		AP83
Vacuum cleaner		AP84	Lawnmower/string trimmer		AP85
Hair cutting machine/electrical shaver		AP86	Plane		AP87
Fan		AP88	Cutter		AP89
Grinding mill (electric)		AP90	Washing machine		AP91
Other (specify)	AP92	AP93	Other (specify)	AP94	AP95
Other (specify)	AP96	AP97	Other (specify)	AP98	AP99
Charging (all appliances that are used for charging)					
Dry cell battery charger		AP100	Mobile phone charger		AP101
Other (specify)	AP102	AP103	Other (specify)	AP104	AP105
Other (specify)	AP106	AP107	Other (specify)	AP108	AP109

Do you use a solar home system?	AP120 Yes ☐ / No ☐	**If yes, how many solar blocks do you use?**	AP121
Do you use car batteries for electricity (and not for driving a car)?	AP122 Yes ☐ / No ☐	**If yes, how many car batteries do you use for electricity?**	AP123
Do you use an electricity generator?	AP124 Yes ☐ / No ☐	**If yes, how many electricity generators do you use?**	AP125

At what distance is the nearest place where you can charge your mobile phone? *(specify the distance in km, if services are available at home put "0")*	AP126	km
At what distance is the nearest place where you can copy or print? *(specify the distance in km, if services are available at home put "0")*	AP127	km
At what distance is the nearest place where you can use a computer to type? *(specify the distance in km, if services are available at home put "0")*	AP128	km
At what distance is the nearest place where you can access the internet with a laptop or desktop computer *(specify the distance in km, if services are available at home put "0")*	AP129	km

6. Safety and efficiency

How many fire outbreaks have occurred in your home during the last 12 months? *(fill in the total number)*	SE01

Do you know how electricity can cause fire outbreaks? *(do not use any examples to explain this question!)*		SE02	Yes ☐ / No ☐
If yes...	**please give some examples** *(briefly write down the answer)*	SE03	

Do you know how a person can seriously be injured or killed by electricity? *(do not use any examples to explain this question!)*		SE04	Yes ☐ / No ☐
If yes...	**please give some examples!** *(briefly write down the answer)*	SE05	

Do you know any measures to reduce electricity costs? *(do not use any examples to explain this question!)*		SE06	Yes ☐ / No ☐
If yes...	**please give some examples!** *(briefly write down the answer)*	SE07	
	Do you apply any of the above mentioned measures? *(ask only households that use electricity)*	SE08	Yes ☐ / No ☐
	If you apply any, please give some examples! *(briefly write down the answer)*	SE09	

How many people were seriously injured due to accidents with electricity at your home during the last 12 months? *(ask only households that use electricity, fill in the total number)*	SE10
How many people were killed due to accidents with electricity at your home during the last 12 months? *(ask only households that use electricity, fill in the total number)*	SE11

Signature interviewee: Signature enumerator:

7 Additional Data in the Digital Annex

0. Overview
1. Coordinator contract template: mandates, tasks, rules, and remuneration
2. Enumerator contract template: mandates, tasks, rules, and remuneration
3. Data entry contract template: mandates, tasks, rules, and remuneration
4. Sample reference letter: letter given to the SLE study team by MEMD
5. Reference letter template: to be adapted and used as proposal for MEMD
6. Preparation list: material purchases and printing to be arranged in Kampala
7. Sampling data sheet: spreadsheet with data on trading centres, health centres, and schools in West Nile
8. WENRECo data sheet: spreadsheet for the WENRECo data
9. Higher-level impact data sheet: spreadsheet for the UNEB and URA data
10. Training for coordinators: topics, materials, and moderation plan
11. Activity planning template for coordinator
12. Definition of the survey area and sampling: selection criteria for the survey area in trading centres and towns
13. Random sampling of households and businesses: a guide for enumerators
14. Training for enumerators: topics, materials and moderation plan
15. Household questionnaire
16. Enterprise questionnaire
17. Health centre questionnaire
18. School questionnaire
19. Water supplier questionnaire
20. Questionnaire explanation sheet: provides information on how to fill in the questionnaires and on some error-prone questions in detail
21. List of interviews per day: to keep track on conducted interviews
22. Financial planning template for coordinators
23. Budget receipt template for coordinators
24. Budget documentation template for coordinators
25. Training for data entry staff: contains information about the 1 day training
26. Data entry form: spreadsheet for the collected field interview data
27. Indicator calculation sheets (folder)

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